THE TEXTILE MANUFACTURER

No. 1026. Vol. 86 Two Shillings and Sixpence June, 1960

Notes of the Month

FIBRES: WORLD PRODUCTION AND TRADE

WORLD production of the chief industrial fibres in the 1958-59 season is estimated to have risen by 5% to a new peak of some 40,300 million lbs., according to *Industrial Fibres*, published for the Commonwealth Economic Committee by H.M. Stationery Office, price 10s. 10d., post free. The increase applied to each of the main fibres apart from flax, hemp and rayon. Among the natural fibres used for apparel and household purposes (wool, cotton, silk and flax) there was a rise of 6% while an increase of 8% was recorded for hemp and jute fibres. For the first time since 1952, there was a reduction in overall production of man-made fibres in the calendar year 1958 of about 7%. Total fibre production in the non-Communist world showed a recovery in 1958-59 following the setbacks of the two previous seasons; it rose by 2% to about 28,400 million lbs. although this was still a shade less than in 1955-56. A noticeable improvement occurred in Commonwealth countries, where there was a 6% rise on the 1957-58 total, mainly as a result of exceptionally large outputs of wool, jute and sisal, which more than compensated for smaller production of cotton, man-made fibres and flax. In the Communist countries further increases in output were reported, estimated in total at rather over 10%. Preliminary information covering the current (1959-60) season indicates that world output of fibres will be higher in aggregate than in the previous season. Increases are expected in wool, cotton and hemp production, although jute and silk are each likely to be reduced. Little change is anticipated in flax production, but that of man-made fibres will certainly show a substantial increase.

Estimated world consumption of the main apparel fibres in 1958 fell by about 2% from the previous year's record total. As a result of the textile recession, usage of wool, man-made fibres and silk fell noticeably, while cotton consumption barely exceeded the record 1957 figure. Among sacking and cordage fibres, usage of hard hemp fell while that of jute was much the same as in the previous season. The year 1959, however, witnessed a fairly general recovery in textile activity and in consequence there was a widespread reduction in end of season stocks that year. Free world stocks of wool fell to their lowest level since the war and cotton stocks were much reduced. Prices of nearly all natural fibres were depressed during 1958, marked falls occurring in wool, silk, long staple cotton, flax and jute. During 1959 values of wool, silk, sisal and flax recovered strongly, but those of jute showed little change until late in the year when a marked improvement took place.

During 1958-59 the overall output of natural fibres in the free world showed a 5% recovery compared with the previous season, but for the first time since 1952, total production of man-made fibres declined. In the calendar year 1958 their output dropped by 9% and their share of aggregate production fell by two points to 17½%. The Commonwealth provided a slightly larger proportion of world output of wool, hard hemp and jute than a season previously, about the same proportion of man-made fibres, but a rather smaller proportion of its cotton. Commonwealth countries continued to produce the bulk of the world's jute, although the quantities grown in China, Thailand and certain other countries are increasing. Among the chief apparel fibres, wool production during 1958-59 in the non-Communist world rose by about 5% compared with the previous season. The increase was most marked in apparel (merino and crossbred) wools and was due primarily to the larger Australian, South African and New Zealand clips. Cotton production during the same season was 3% more than in 1957-58; the largest increase occurred in the U.S., where record yields more than compensated for the loss of five million acres of cotton taken out of production under the soil bank programme. Silk production was 6% higher than in the previous year. The fall in the output of man-made fibres was confined wholly to rayon and acetate (decline 11%), since output of nylon and the newer non-cellulosic types advanced by a further 1% during 1958. Production of non-apparel fibres rose by about 9% over the previous season's total, with a 14% increase in jute output offsetting a slight reduction in sisal and other hemps.

Industrial Fibres in the Free World
(thousand million lbs.)

	Pre-war average	1955-56	1956-57	1958-59
Wool (clean basis)	1·8	2·3	2·5	2·5
Cotton	11·6	15·1	14·3	14·0
Rayon and acetate:				
Filament yarn	1·0	2·1	2·0	1·8
Staple fibre	0·4	2·2	2·5	2·3
Nylon and other man-made fibres	—	0·6	0·6	0·9
Flax	0·2	0·3	0·3	0·2
Hemp (including sisal)	1·8	2·0	2·1	2·1
Jute	3·3	4·0	4·1	4·6
Total*	20·2	28·7	28·3	28·4
Man-made fibres as per cent. of total	6·9	16·9	17·9	17·5

* Including silk, which has not been shown separately.

Prices of most natural fibres were depressed in 1958, but early in the following year wool, silk, flax, sisal and jute all became firmer. Cotton, however, continued to fall until the second half of 1959, when quotations steadied. Except for jute, prices of the natural fibres in 1959 were higher on average than in 1958 and in most cases the year closed with values showing renewed strength. Apart from the downward revision of the price of viscose staple in May 1959, to keep it competitive with cotton, and the raising of the "Terylene" price in the following month, manufacturers' quotations for man-made fibres in the U.K. showed little change. After falling to their lowest level for eleven years in January 1959, merino wool prices subsequently made a good recovery, and at the close of the selling season last June were about 10% above the season's opening level. In the first half of the current season, however, wool values again

weakened somewhat, although a good part of the loss was subsequently regained. World prices of medium staple cotton showed a generally downward trend over the greater part of the 1958-59 season, although a steadier tone developed in the opening months of the current cotton year. In silk and flax the downward trend in quotations was reversed at the beginning of 1959, while in sisal a marked recovery in prices took place in 1959. The decline in jute prices in the early months of the 1958-59 season led the Pakistan authorities to reimpose minimum export prices as from October 1958; thereafter the market was effectively stabilised at, or slightly above, the official price level.

The Commonwealth is an important supplier of industrial fibres to the rest of the world. The great bulk of the raw jute entering international trade is of Commonwealth origin, together with just over three-quarters of the wool, nearly two-fifths of the hemp, and about a tenth of the cotton and man-made fibres. The Commonwealth has a substantial net export balance in fibres, since its exports of wool, jute and hemp outweigh its imports of cotton, flax, rayon and silk. Between 1957 and 1958 the overall export balance, on a weight basis, rose by 50% due principally to larger exports of jute and hemp and to markedly smaller imports of cotton, man-made fibres and flax. A new section in the review shows the main destinations of Commonwealth exports of fibres. Western Europe, including the U.K., is the chief market for Commonwealth exports of wool, sisal and jute, while the main markets for its cotton are now in Asia.

A substantial proportion of the U.K. imports of wool, hemp, jute, coir and kapok are of Commonwealth origin, but a much smaller share of its cotton and mohair. About 80% of this country's wool and hemp supplies are normally drawn from the Commonwealth and virtually all of its jute, coir and kapok. Compared with pre-war the Commonwealth's share in U.K. imports of wool, hemp and kapok has in each case increased, but for cotton, jute and mohair it has declined. A special section in the review describes changes in the position of the six Common Market countries of Western Europe as markets for Commonwealth fibres. Nearly all Western Europe's supplies of raw jute normally came from Commonwealth sources, together with over 80% of its wool imports and about a third of its hemp. By contrast, fairly small quantities of Commonwealth cotton are imported, and "the six" are themselves substantial producers of man-made fibres and of jute manufactures, both of which are protected by relatively high import duties.

Although production of the newer non-cellulosic man-made fibres rose to around 930 million lbs. during 1958, the rise, which was of the order of 2%, was far less pronounced than in any earlier year for which statistics are available. Between 1956 and 1957, for example, the rise was about a third. Production of non-cellulosic fibres actually declined in two of the largest producing countries, the U.S. and the U.K., constituting the first year to year drop yet recorded. However, the setback was purely temporary and textile activity began to recover in 1959.

HIGHER ACTIVITY IN THE JUTE INDUSTRY

MUCH better activity in the jute trade during the past year was reported by Mr. J. R. L. Halley, retiring chairman, at the recent annual meeting in Dundee of the Association of Jute Spinners and Manufacturers. He said that jute firms were doing their utmost to develop and extend the manufacture of specialised products upon which the industry in Dundee and district would continue to depend. In these developments they had the valuable assistance of the Jute Research Association whose membership included every firm on the production side of the industry. Referring to the Board of Trade's policy on safeguards against abnormal imports from "low-cost" countries, Mr. Halley said that reductions in the "mark-up" on these imports which took place in 1957 and again recently were having logical effect. While the Board of Trade had given way to pressure from India on these occasions, they were fully aware of the importance of the jute industry to employment in the Dundee area. He was convinced the point had now been reached when official erosion of the industry's position had to be stopped if wider consequences were not to be felt in the area.

On recruitment and training, Mr. Halley said that there were close relations between the local technical and commercial colleges and the Association, who had agreed to provide four annual prizes in commerce. The encouragement of day-release was now the policy of the Association, and the practice was growing, particularly in relation to the management studies department at the technical college. The Association, he added, were much concerned at the numbers of young people in Dundee who would be looking for work on leaving school during 1961-63. This would be 50% greater in the city than of recent years. The industry, like others, had been urged by the British Employers' Confederation to extend its training facilities to the utmost. He drew attention to the extreme shortage of trainee loom tenters throughout the jute industry and said that special efforts would be needed to double at least the present number of apprentices. Mr. Halley intimated that the next meeting of the management committee of the European Jute Association would be held in June at Gleneagles.

* * *

HARROGATE CONFERENCE HERALDS NEW ERA

THE Second Quinquennial Wool Textile Research Conference, at Harrogate, opened a new era for wool and wool textiles. Behind the titles of 77 papers being presented to 460 world wool scientists at the conference were revolutionary advances which, it is stated, placed wool firmly in the forefront as the world's most modern scientifically-developed fibre. Men and women throughout the world will be affected by the discussions at Harrogate, which concerned easy-care "wash and wear" and other processing developments soon to be applied to woollen and worsted clothing. These discoveries—the result of intensive research—are undergoing exhaustive tests before being introduced to woollen and worsted cloth manufacturers. An important feature of their development is that great care has been taken to ensure that they do not affect wool's many natural characteristics, which include insulation against both heat and cold, colour fastness, good handle, elasticity (which aids shape retention and crease resistance), and a high flame-resistance rating. Papers presented and discussed covered, among other topics, washable non-iron wool fabrics, shrinkproofing processes, and clean boiled hospital blankets. There were many references to the basic cellular structure of wool—a great mystery yet to be solved by modern science. In opening the conference, R. G. Lund (chairman, I.W.S.) said that the sum spent on wool research throughout the world was still pitifully small—about £1 million on wool production research, and about the same sum on other wool research. Compared with the annual value of the world wool clip that was only about half of 1% or, if the value of cloth production was taken as a base figure, little more than one-fifth of 1%. He appealed to industrialists everywhere to sponsor and stimulate wool research.

Polyamides and Polyesters

Constitution, production, properties and some of the ever-widening uses in domestic and industrial spheres of nylon and "Terylene" in filament and staple form, also new processes to modify c.f. yarns

By J. W. S. HEARLE, M.A., PH.D., A.INST.P., F.T.I.

NYLON and "Terylene" have formed the effective vanguard in the spread of synthetic fibres throughout the textile industry. Their success, which in almost every case has resulted in the demand outstripping the steadily increasing supplies, has been due mainly to new and valuable properties additional to those features in the older fibres. There are a number of polyamide and polyester fibres but the most common—with which this article is mainly concerned—are nylon 66, e.g. du Pont nylon or British Nylon Spinners Bri-Nylon and "Terylene" (or "Dacron"). Some of the other fibres will, however, be mentioned.

The four essential stages in the production of nylon comprise (a) preparation of the new materials, i.e., hexamethylene diamine and adipic acid; (*b*) condensation into a polymer; (*c*) melting of the polymer chips followed by extrusion into filaments and (*d*) cold-drawing the filaments. These processes are illustrated schematically in Figs. 1 and 2. When du Pont commenced production of this new fibre they were, in fact, starting from "scratch" since there is no other large scale demand for hexamethylene diamine or adipic acid; consequently, they are expensive to produce as a very high standard of purity is required. In the second stage of the operation, i.e. actual polymerisation, the reaction conditions have to be carefully controlled to ensure polymer molecules of the right length. If they are too short, the fibre will be very weak, but if they are too long, filaments cannot be extruded successfully. The actual extrusion—which involves forcing the molten polymer through very fine orifices—must be carried out in an inert atmosphere to avoid degradation.

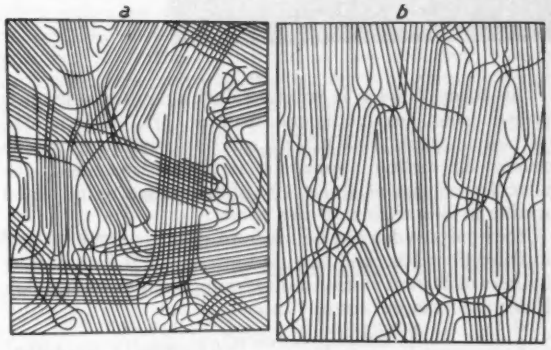


Fig. 3(a). Suggested molecular arrangement in unoriented nylon

Fig. 3(b). Suggested molecular arrangement in drawn nylon

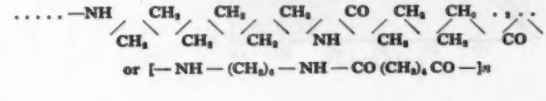
In the filaments immediately after extrusion there is little or no preferential orientation of the molecules. They point equally in all directions and the resulting fibre is easily stretched, but will not contract again on being released; in this state it is virtually useless for any normal textile purpose. However, by drawing out the extruded fibres to about four times their original length, the molecules are pulled into a highly oriented arrangement, whereby the characteristic textile properties are realised. This process—cold-drawing—is carried out without applying heat, although the energy dissipated in extending the fibre may cause the actual material to heat up.

Nylon may be made either as continuous filament yarn or as a coarse tow for conversion into staple fibres. Produced now in many countries it is marketed in a wide variety of deniers, filament numbers and staple lengths. The mechanical properties are modified by varying the amount of stretch during manufacture, and both medium- and high-tenacity types are available. The lustre of the filaments may be semi-full, fully dull, or bright.

The steady expansion in nylon production is clearly apparent in Table 1.

Constitution of Nylon

The common form of nylon has the formula:—



or $[-NH-(CH_2)_6-NH-CO(CH_2)_4CO-]_n$

How a Nylon Polymer is made

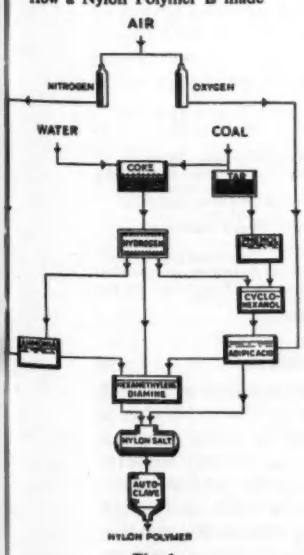


Fig. 1

How a Nylon Yarn is made

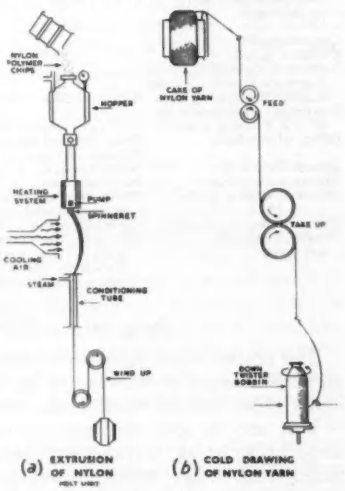


Fig. 2

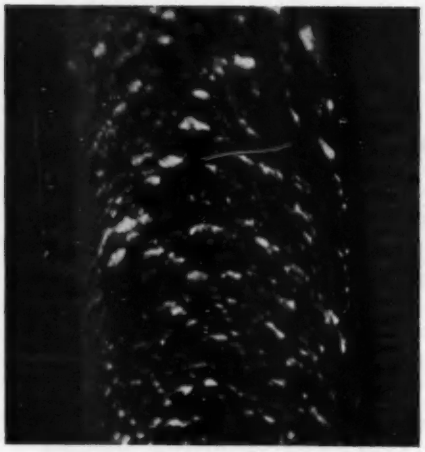


Fig. 4. Electron micrograph of nylon fibre—viewed in reflection microscopy with great foreshortening appearance

Table 1. Production of Polyamide and Polyester Fibres (million lb. per annum)

Country	Polyamide (Nylon, etc.)			Polyester ("Terylene", "Dacron")		
	1953	1955	1957	1953	1955	1957
U.K.	14	31	46	1	6	25
U.S.A.	184	260	320	7	27	54
Japan	4	18	49			(4)
Italy	5	10	20			
Soviet Union ..			33			
Canada ..			20*			
France ..			44*			(7)
West Germany			43*			(5)
Netherlands ..			8*			
Belgium ..			4*			
Switzerland ..			6*			
Other countries (free world)			8*			
East Germany			14*			
Poland ..			5*			
Czechoslovakia			3*			

* Total non-cellulosic man-made fibre production.

This form of nylon is strictly called nylon 66, since it is derived from hexamethylene diamine, $H_2N(CH_2)_6NH_2$, and adipic acid, $HOOC(CH_2)_4COOH$, both of which contain six carbon atoms. In a typical specimen, the molecules consist of about 100 of the above units joined together in long chains.

Other polyamides can be made from other diamines and dicarboxylic acids, and are designated by the respective numbers of carbon atoms in these components. Thus nylon 610 has the formula:

$$[-NH(CH_2)_6NHCO(CH_2)_8CO-]_n.$$

Another variety of polyamides is derived by condensation of amino-acids:—

$$H_2N-R-COOH + H_2N-R-COOH$$

$$\downarrow$$

$$H_2N-R-CO-NH-R-COOH + H_2O$$

continues ↓ indefinitely

$$[-NH-R-CO-]_n$$

In this case, as only one component is involved in the polymerisation, a single number characterises the polymer. For instance, nylon 6, which is produced in various countries, e.g. in Germany as Perlon, and in the U.S.A. as Caprolan, has the formula $[-NH(CH_2)_5CO-]_n$, and nylon 11, which is produced in France as Rilsan, is $[-NH-(CH_2)_{10}CO]$—*c*. In general these different polyamide fibres are similar to ordinary nylon, though there are minor differences.

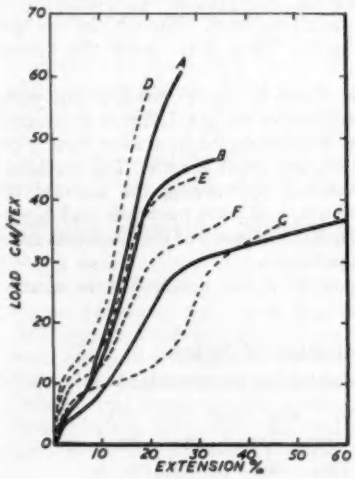


Fig. 5. Load extension curves (du Pont fibres)
A—840 den., Type 300 (high tenacity) nylon
B—40 den., Type 200 nylon
C—nylon staple fibre
D—220 den., Type 51 (high tenacity) Dacron
E—250 den., Type 55 Dacron
F—70 den., Type 56 Dacron
G—Dacron staple fibre
- - - - - Dacron
——— nylon

In both undrawn and drawn nylon filaments, about 50% of the material is packed into a regular crystalline order, while in the remainder the molecules are more disordered. The sort of change of structure which must occur on drawing, when the crystallites are oriented along the fibre axis, is illustrated by Fig. 3.

In form, nylon filaments are round in cross-section, regular along their length and comparatively featureless in cross-section, although there is some evidence of a thin skin differing in properties from the rest of the fibre. Viewed at very high magnification, in an electron microscope, the surface of a nylon fibre (Fig. 4) appears covered with "cobble-stones". In the undrawn fibre these are approximately spherical projections which are extended out into an elliptical shape on drawing.

Table 2. Properties of Nylon and "Terylene" Fibres

	Nylon			"Terylene"		
	Medium tenacity	High tenacity	Staple	Medium tenacity	High tenacity	Staple
Tenacity, g./tex ..	45	65	40	45	60	35
Breaking extension, %	30	20	35	22	10	35
Work of rupture, g./tex	5·5	6·0	8·0	5·5	5·0	7·0
Elastic recovery from						
Half breaking load ..		0·85			0·80	
Half breaking ext. ..		0·85			0·80	
Wet strength / Dry strength × 100%		90			100	
Density, g./c.c.		1·14			1·38	
Refractive index						
Light vibration, 11 axes		1·55			1·72	
Light vibration, ⊥ axis		1·52			1·54	
Electrical resistance at 65% R.H., ohm g./cm.²	Very dependent on anti-static finish					
Effect of sunlight ..	Some loss of strength No discolouration			Some loss of strength No discolouration		
Attack by moths ..	Not attacked			Not attacked		
Attack by mildew ..	Not attacked			Not attacked		
Effect of strong acids ..	Disintegrated by conc. mineral acids			Very resistant		
Effect of strong alkalis	Virtually none			Disintegrated at boil		
Effect of organic solvents	Soluble in some phenolic compounds and in conc. formic acid			Soluble in some phenolic compounds		

Properties of Nylon

The properties of nylon fibres are summarised in Table 2, and load-extension curves are given in Fig. 5. Nylon is easily stretched by small loads, since its initial modulus is low, and its load-extension curve has a fairly uniform slope up to break, without any steep initial portion. Compared with other fibres, nylon shows moderately high strength and moderately high breaking extension—together these combine to give a very high work of rupture, repres-

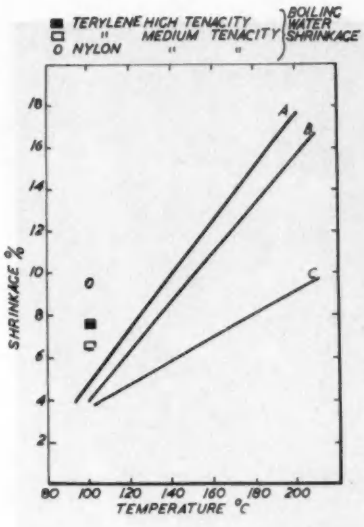


Fig. 6. Contraction of nylon and "Terylene" on first heating (in air)
A—"Terylene," high tenacity
B—"Terylene," medium tenacity
C—nylon, medium tenacity

ented by the area under the load-extension curves. This means that a great deal of energy is needed to break nylon, and so it is a very tough fibre. Nylon also shows extremely good elastic recovery: even after being extended to 80% of its breaking extension, it still shows an elastic recovery of 75%. Toughness and good recovery are the two properties which make for good abrasion resistance, so that nylon is the most hard-wearing of textile fibres—with the result that while our mothers had to darn socks continually, our wives need no longer do so.

Another outstanding feature of nylon is its heat-setting properties, i.e., if the filaments are heated while in some deformed configuration, they will be set in this form and return to it provided the effective setting temperature is not exceeded. In this way, pleats can be set in a fabric, but unwanted creases can be avoided and the necessity for ironing is eliminated: this really was the beginning of "drip-dry".

Nylon absorbs far less water than any natural fibre. This has advantages and disadvantages, which have, on the whole, both been exaggerated in the past. It makes the material somewhat easier to dry, though the water held between the fibres constitutes the largest part of the water in any wet fabric, and will be about the same amount in any fabric of the same weight and bulk. On the other hand, the discomfort, which may occur in hot weather due to the failure of the nylon fibres to transmit moisture, can be avoided by employing suitably open yarn in similar fabric constructions.

Due to the low moisture absorption, there is little swelling of the fibre, and so its dimensions remain stable in changing conditions. Neither does water destroy the effects of heat-setting, although setting in water or steam at a particular temperature has the same effect as setting in air at a higher temperature. In other words for the same actual temperature, the effective setting temperature is higher in water than in air. Another indirect consequence of the low moisture absorption of nylon is its high electrical resistance, which renders the fibre liable to collect static electricity. This can create difficulties in processing and also lead to rapid soiling, etc.

On heating nylon yarn for the first time to temperatures above 60°C., it contracts, or if restrained from contracting will develop a contractile force. Most of the contraction is irreversible—once it has occurred it is not repeated— but a small part of it is reversible, and means that the fibre shows a negative coefficient of thermal expansion. Typical figures for the contraction of nylon on the first heating are given in Fig. 6. Chemically, nylon is reasonably stable, although it is subject to degradation and a reduction in strength on exposure to ultra-violet light. The price of nylon is comparatively high as will be observed from the typical values set out in Table 3.

Uses of Nylon

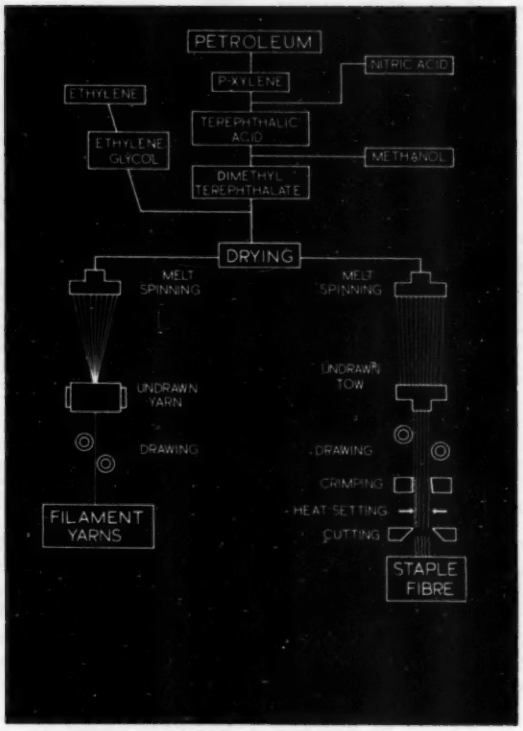
First produced just before the second world war, nylon achieved its first big outlet when it proved to be the best material for parachute fabrics. Indeed, the subsequent dumping of surplus parachute fabric on the market after the war did much to give nylon a bad name for it was definitely an unsuitable fabric construction for dress goods. The other immediate success was for ladies' stockings, where nylon has captured by far the greatest share of the market. The introduction of staple fibres, and bulked yarns, gave rise to further expansion in use and men quickly appreciated the remarkable wearing properties of nylon socks. Nylon has steadily been adopted in a wide-range of fabrics used for lingerie, dresses, shirts and so on; bulked yarns are used in knitwear and some woven materials; and

Table 3. Examples of Fibre Prices (pence per lb.)

Staple Fibre:			
Nylon, 1·5 den., 1½ in.			123d.
3 den. to 18 den., various lengths			117d.
"Terylene", 1·5 den., 1½ in.			126d.
3 den. to 10 den., various lengths			120d.
black, 4 den., various lengths			150d.
Continuous Filaments:			
Nylon, 6 den., monofilamemt			906
15 „ monofilament			431
20 „ multifilament			314
70 „ „			137
100 „ „			135
205 „ „			129
210 „ high tenacity			126
840 „ extra high tenacity			111
"Terylene", 25 den., multifilament			228
75 „ „			145
100 „ „			140
250 „ high tenacity			126
1,000 „ high tenacity			111
10,000 „ high tenacity			108

Fig. 7(a). Socks made from Bri-nylon

(left) Fig. 7(b). Waterproof threequarter length Brinylon coat



(right) Fig. 8. "Terylene" filament yarn and staple fibre production flow sheet

nylon is being increasingly blended with other fibres, e.g. wool to give harder wearing suitings.

Nylon—particularly the high-tenacity yarn— has also found many industrial uses. Its qualities may be illustrated by the way it meets the needs of a specialised end-use such as climbing ropes: its advantages over other ropes are the light weight for a given strength, the very high work of rupture which means that it will stop and support a man who is falling at high speed, and the small effect of moisture. In the biggest industrial outlet, the tyre-cord market, nylon has had some success particularly in some special applications, such as aircraft tyres where lightness is a great advantage. For more general use, the properties of nylon and rayon are fairly evenly matched, but nylon works out about 25% more expensive. A few of the varied end-uses of nylon are shown in Fig. 7.

Production of "Terylene"

The production of "Terylene" is generally similar to that of nylon, except that the polymer is made by a different condensation reaction—between terephthalic acid and ethylene glycol. The former compound, which accounts for about 75% of the fibre by weight, was not in commercial production, so that again the fibre production had to begin with plant to produce the raw material. The complete sequence of operations is shown in Fig. 8. In contrast to

Fig. 7(c). These huge tyres are part of the landing gear of the Comet. Reinforced with nylon, the tyres are extremely tough, adequately withstanding terrific strain

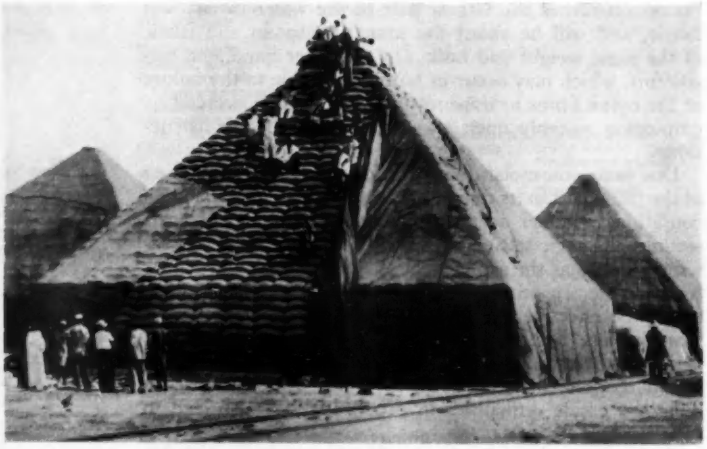


Fig. 7(d). P.V.C. or Neoprene proofed nylon fabrics are being used as fumigation canopies for the disinfestation of harvested crops in Nigeria and other parts of Africa

(left)
Fig. 9(a) Demonstrating the excellent washing and crease-retention properties of "Terylene".

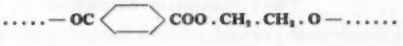
(right)
Fig. 9(b). Many laundries use calendar sheetings and laundry nets made from 100% "Terylene"

nylon, the drawing operation is carried out on heated yarn, at about 60°C.

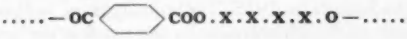
By arrangement with the Calico Printers Association, who hold the patents, "Terylene" is produced in this country by I.C.I. Ltd., while du Pont produce the same sort of fibre in the U.S.A. under the name of "Dacron". Licences for production in various other countries have now been granted by I.C.I. Ltd., and different trade names are in use—usually variants of TER, often combining the name of the producing company, e.g. Terlenka. Some production figures are included in Table 1. A different sort of polyester fibre is produced by the Tennessee Eastman Co. with the name of Kodel. Its properties are generally similar, but not identical with those of "Terylene".

Constitution and Form of "Terylene" Fibres

"Terylene" is a polyester fibre since it results from the condensation between a dibasic acid and a double alcohol (or glycol). The forumla is:—



A typical molecule will be composed of about a hundred of these units. Undrawn "Terylene" is unoriented and is not crystalline, but on drawing the introduction of orientation brings about cystallisation. Consequently "Terylene" fibres have the same combination of crystalline (about 50%) and disordered regions, shown in the structure of other fibres. The constitution of "Kodel" has not been announced, but it is believed to be a polyester formed by terephthalic acid with some other glycol. If this is so, the molecular formula will be:



If all the X's are CH_2 groups it will differ from "Terylene" in much the same way that nylon 66 differs from nylon 610.

Properties of "Terylene"

The properties of "Terylene" are included in Table 2 and Fig. 5. In many ways "Terylene" is similar to nylon. Its breaking-points lie in the same range, depending on the

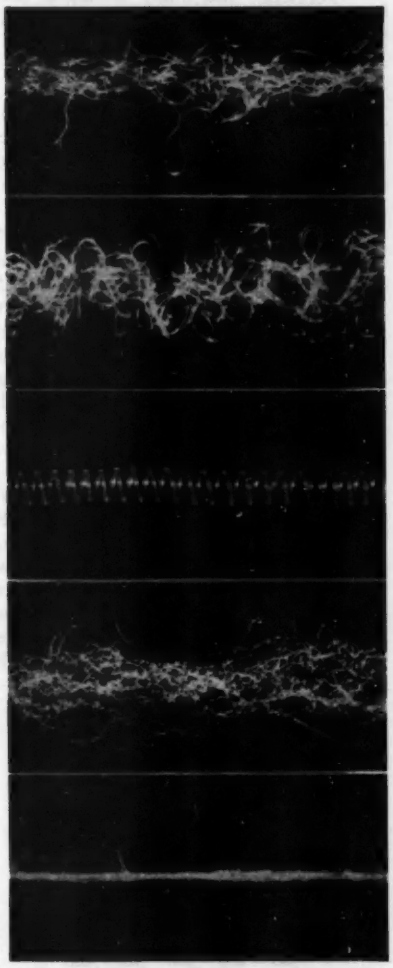


Fig. 10
(Reproduced by courtesy of Mr. D. F. Arthur from Jour. Tex. Inst., Vol. 49, No. 11, P. 640)

amount of orientation; it shows good recovery, though not quite as outstanding as nylon, and high abrasion resistance; it has an even lower moisture absorption, a high electrical resistance, and is subject to static electricity; it can be heat-set, and contracts on heating; and its price (Table 3) is much the same. Perhaps the most obvious difference is in the shape of the load-extension curve. The intial slope of the curve is steep, i.e. "Terylene" has a high modulus, and is not easily stretched by small forces. This must be the major factor in causing the handle of "Terylene" fabrics to differ from those of nylon, although other less well-understood properties, such as bending, torsion and shear resistance, may also play an important part. Chemically, "Terylene" is somewhat more inert than nylon.

Uses of "Terylene"

For some types of dress goods, the handle of "Terylene" is felt to be preferable to that of nylon. Perhaps the greatest success of "Terylene" has been in blends with other fibres. For example, blends of "Terylene" with wool in suitings have given high-grade fabrics which can be maltreated with impunity. And blends with cotton have proved popular for pyjamas and shirts, while textured blends of continuous filament "Terylene" with rayon have been very highly praised.

"Terylene" has many industrial uses. To some extent the comparative success of nylon and "Terylene" in finding industrial markets has depended on the chance preferences of consumers, or the particular choice of programmes by the respective Te hnical Development Departments; but it is also influenced by the differences in properties. For some purposes the stiffness of "Terylene" is a distinct asset; for others the easy extensibility of nylon is preferred. Examples of the uses of "Terylene" are shown in Fig. 9.

Modified Continuous Filament Yarns

At first nylon and "Terylene" were used in conventional textile processes, either as continuous filament yarn or as staple fibre. But their heat-setting properties have given rise to new processes to produce new modified continuous filament yarns. There are three such processes in use today (*a*) the false-twist process; (*b*) the "Agilon" process, and (*c*) "Ban-lon" process—while a fourth new process for producing textured yarn, the "Taslan" process, can be applied to any continuous filament yarn and is not dependent on heat-setting properties. The false-twist process consists of twisting the yarn, heat-setting it, untwisting it, and then allowing the yarn to contract. Because of the heat-setting, the stable configuration of the individual filaments is the twisted one, and thus in the untwisted, flat yarn the filaments will be under torque, will be twist lively, and will snarl up to give the bulked yarn. Formerly this process was carried out in a series of separate stages, but the use of a false-twist spindle, in combination with a heater, enables

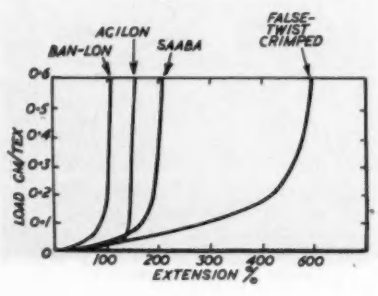


Fig. 11. Load-extension curves of bulked nylon yarns (initial very low tension region only)

Table 4.
Water Retention of Yarns after Draining for a Given Time (indicative of bulk)

Yarn	Water retained %
False-twist crimped	1,650
"Ban-lon", High Bulk	1,000
"Ban-lon", Normal Bulk	900
"Agilon"	900
"Taslan"	600
"Saaba"	1,100
Continuous filament	350

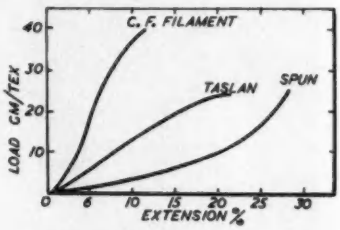


Fig. 12. Load extension curve of "Taslan" yarn, between C.F. and spun yarns

the whole process to be carried out in one operation. A further heat treatment, as in the Saaba process, may be used to stabilise the bulked yarn at any degree of stretch, and further modify its properties.

In the "Agilon" process, crimp is put into the yarn by passing heated yarn over a sharp edge, while in the "Ban-lon" process the yarn is crimped by stuffing it into a heated box. Photographs of some of these yarns are shown in Fig. 10. Their characteristics, and the way they differ from one another or vary according to processing conditions, are high bulk, a high degree of stretch under low loads (up to 3 or 4 times the contracted length for false-twisted bulked yarns) and the particular appearance and surface texture which they give to fabrics. The first two of these features are illustrated in Table 4 and Fig. 11. The "Taslan" process consists in overfeeding yarn through an air-jet so that the excess length is blown out in small loops on the surface of the yarn. This gives bulk, and the feel of a spun yarn, without giving the high-stretch behaviour, which is sometimes a nuisance. The load-extension curve of a "Taslan" textured yarn lies between the curves for ordinary continuous filament and spun yarns. (Fig. 12)

The Changing Situation

Polyamide and polyester fibres are contributing strongly to the changing situation in textile technology. In the near future, it seems unlikely that any new fibres of these two types—or, at least, any with new properties—will be developed. However, the expiration of some of the most important patents, will doubtless add to the number of producers competing for the markets. Combined with the effects of larger-scale production, and the completion of writing-off the initial capital costs of development and plant, this should lead to a reduction in prices; although it is perhaps unduly optimistic to think that there will be anything like the fall in the price of rayon from 200d./lb. in 1920 to 32d./lb. in 1935. Technically there will be continued research and improvement in the production processes and the quality of the product, but the most obvious results will come from the development of new ways of using the fibres—the exploration of new end-uses, and the perfecting of new ways of processing the fibres and yarns. At present, the emphasis is on bulked yarns and almost every month shows some important advance.

Suggestions for Further Reading
"Fibres from Synthetic Polymers". R. Hill (editor)

Principles of Roller Drafting*

Consideration of the conditions and problems encountered in drafting, such as force required to rotate top roller, surface speed of top rollers, drafting and yarn regularity, also mechanical defects including (a) those affecting the relative position of the roller nips and (b) those affecting the effective surface speed of the rollers

By A. E. DE BARR†

IF we confine our attention to the usual form of drafting system in which the rollers are intended to be driven at constant velocity, we can easily arrive at the first, and from some points of view the only, principle of roller drafting. Whilst we have learned recently that what goes up does not always come down again, nevertheless with the constant velocity type of roller or apron drafting system what goes in must come out. Referring to the usual type of drafting system, this important and fundamental principle can be expressed mathematically as:—

$$\text{Mean value of } \frac{\text{Weight per unit length in}}{\text{Weight per unit length out}} = \text{constant}$$

where the ratio on the L.H.S. of this equation is averaged over a time corresponding to several revolutions of the back roller.

You may think that this relation is so obvious that it is hardly worth stating. But I think that you will be wrong in so thinking, for the equation is important in two respects—firstly for what it does represent and secondly for what it does not represent.

In so far as the equation holds, it expresses a cardinal virtue of conventional roller and apron drafting systems for which you—as quality control specialists—should be profoundly thankful. As with so much textile machinery, this virtue is so intimately associated with drafting systems that it is often overlooked or unconsciously taken for granted. But the innate conservatism of a conventional drafting system is a very valuable feature. Without it the control of count variation might well be very much more difficult—a point that can perhaps be better appreciated by considering the situation that would result if the mean count of the yarn produced by each individual drafting system were determined not only by the mean hank number of the roving feed as at present, but also upon some variable factor in the drafting system itself. That you can, for purposes of count control, treat whole frames or preparations together, is possible only because of the principle expressed in this equation.

It has from time to time been suggested that instead of drafting with constant front roller speed, fibres should be drafted with a constant drafting force. With this system, as with a drafting system in which some kind of automatic control system is used to vary the speed of one or other pair of rollers in such a way as to reduce the irregularity of the yarn, the mean draft is not necessarily constant and, in general, each individual drafting system produces yarn of a different mean count from the same roving. Thus although the short-term irregularity of the yarn may be reduced in these ways the reduction might well be achieved only at the expense of considerably increased count variation.

Let us consider what this equation does not tell us. It does not enable us to say anything useful about the actual weight per unit length of the material delivered at any instant. Nor can we assign any exact value to the constant on the R.H.S. of the equation—usually referred to as the mean draft—although we can say that it is approximately equal to the ratio of the surface speeds of the front and back rollers. It is worth emphasising again here that the equation holds only if the roller speeds and diameters remain constant and if the thickness of the material fed does not change.

Conditions for Drafting to Proceed

I propose now to look at the problem in a different way and to consider the conditions that must be fulfilled if drafting is to take place at all. If we consider the usual sort of drafting system and imagine the roller setting to be correct in relation to the length of the fibres to be drafted, there seem to be only two important conditions. First, that the frictional grip of the roller nips on the material between them must be greater than the force necessary to draft the fibres. Second, that the roving must be sufficiently coherent to enable fibres emerging from the back rollers to be carried through to the front rollers. This second requirement is easily met with short staple fibres: I shall not consider it further here but shall have more to say about it later. The first requirement is not always so easily fulfilled and merits further discussion.

(*a*) *Drafting Force.*—Drafting involves relative movement of fibres and, since these are never perfectly smooth, there is a frictional resistance to this relative movement. A force—the drafting force—is required to overcome this frictional resistance and this must be provided by tension in the fibres and supported by the frictional grip at the roller nips.

The drafting force is proportional to the number of fibres in relative movement and is therefore inversely proportional to the draft used. The drafting force also increases as the roller setting decreases, slowly at first and then, as the fibre length is reached, much more rapidly. The initial slow increase is probably associated with an increase in the number of contacts between back roller fibres and the fibres being withdrawn by the front rollers. The nature of the material being drafted—the degree of entanglement of fibres and of fibre parallelisation—also influences the magnitude of the drafting force.

Clearly the drafting force has the effect of pulling back the material between the front rollers and of pulling forward the material between the back rollers, and unless the frictional grip at the roller nips is adequate there will be slippage between the fibres and the rollers instead of the desired slippage between fibres. The grip at the roller nips must balance the difference between the drafting forces in the zones on each side of the pairs of rollers considered. In practice, the situation is more complicated and, whilst the principle remains the same, there are forces other than the drafting forces to be considered as well.

(*b*) *Force Required to Rotate Top Roller.*—Consider, as on the figure, a sliver passing through a pair of rollers without drafting. If the force required, at the surface of the top roller, to rotate the top roller against the friction in its bearings is F_1, then there will be an equal and opposite force F_1 on the portion of the sliver in contact with this roller. There will also be a set of forces F_3, distributed over the thickness of the sliver, opposing the compression of the sliver and maintaining it in a straight line. Both these forces oppose the movement of the sliver through the nip and in order to keep it moving a force F_2 must be supplied by the bottom roller. These three forces must fulfil the condition

$$F_2 = F_1 + F_3$$

In general the moments of F_1, F_2 and F_3 about the axis of the bottom roller will not be in equilibrium and a balancing couple must be provided by the reaction of the sliver on the rollers.

When the material is being drafted there will also be the drafting forces in the zones on each side of the pair of rollers to be considered. The complete set of forces acting along the length of the sliver in these circumstances is shown in Fig. 1. It will be seen that the force to be provided at the roller nip will, in general, be greater than the drafting force if slip between fibres and rollers is to be avoided.

If the bulk of the material in the roller nip is small, as on ringframes and fine roving frames, the top roller is usually driven by direct contact with the bottom roller and the force F_1 does not have to be provided by the sliver. Further, under

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* *A paper given at the recent conference on "Drafting and Yarn Quality" organised by the British Association for Quality Control Textiles.*

† *British Cotton Industry Research Association.*

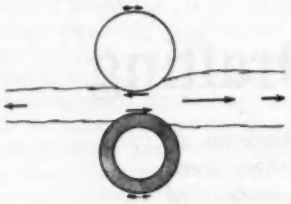

Fig. 1.

these circumstances F_3 is small so that the force to be provided at the roller nip is only the difference between the drafting forces in the zones on each side of the pair of rollers considered. On slubbing frames, drawframes and sliver-lap machines, however, the bulk of material between the rollers is often so great that the top and bottom rollers are not in contact and the top roller is driven only via the sliver as already described. Under these circumstances the force to be provided at the roller nip may be appreciably greater than the drafting force in either zone and a very effective grip of the fibres by the rollers is required.

The importance of adequate grip at the roller nips of drawframes and sliver-lap machines is now recognised. In recent years this problem has been tackled by the introduction of improved forms of roller fluting, alteration of draft distributions, and the introduction of various forms of roller arrangement of which those with a 1-over-2 or 2-over-1 combination seem to be particularly successful. The use of roller-bearing top rollers in order to reduce F_1 is also very beneficial: it might perhaps one day be possible to use magnetic top rollers on drawframes and thus virtually eliminate the force F_1.

(*c*) *Surface Speed of Top Rollers.*— Referring again to the figure, the portion of the sliver in the roller nip is, in general, in shear. Under the circumstances shown that part of it in contact with the top roller travels more slowly than that part in contact with the bottom roller. The surface speed of the top roller is therefore less than that of the bottom roller. In practice, depending upon the magnitudes of the frictional, compressional and drafting forces involved, the surface speed of the top roller may be greater or less than that of the bottom roller. Note that this is not as a result of slip: this speed difference will be present even when the drafting system is behaving properly. When the bulk of material in the roller nip is large the speed difference may, in extreme circumstances, be as much as 8 - 10%.

The speed with which the sliver passes through the roller nip is, in general, not equal to either top or bottom roller speed. In passing through the roller nip some parts of the sliver are in compression and others are in tension. The speed of the sliver as a whole depends largely upon the extent to which it recovers from the resulting strains. Experience suggests that the compressional strains tend to have a permanent effect so that the speed of the sliver approximates to that of the slower of the two rollers. (It might be pointed out in passing that, even without fibres in the roller nip, the speeds of top and bottom rollers are rarely exactly equal. Compression and deformation of roller coverings lead to speed differences of the same general kind as those caused by fibres. In particular, leather and flannel covered top rollers, in direct contact with steel bottom rollers, have a greater free surface speed than the bottom roller: with synthetic-covered top rollers the effect is reversed. In each case the speed differences are of the order of 1 - 2% depending upon the weighting of the rollers, the maximum speed difference being 0·8% with leather-covered rollers and 2·8% with synthetic-covered rollers.)

It will now be clear why stated earlier that no exact value can be assigned to the constant in this equation—the mean draft. The mean value of the ratio of the effective surface speeds of front and back rollers is clearly not, in general, equal to the ratio of the surface speeds of the bottom rollers, although the difference may only be small. Furthermore if the bulk of the material fed, or the roller settings or the roller weighting is changed the mean draft is apt to be changed slightly also.

Since, for constant bottom roller speeds, the surface speeds of the top rollers are dependent upon the magnitudes of the drafting forces in the different zones, the surface speed of the top rollers can be used as an index of the performance of drawframes, sliver lap machines, etc. The value of this measurement for this purpose lies in the fact that it is more sensitive than, say, the mean deviation of the sliver as usually measured, to changes in drafting conditions (see Fig. 2). Thus a regular check on the surface speeds of top rollers of drawframes, say, enables any deterioration in drafting conditions to be detected before the quality of the sliver has changed appreciably. A routine check on surface speeds of top rollers also enables any gross faults to be detected.

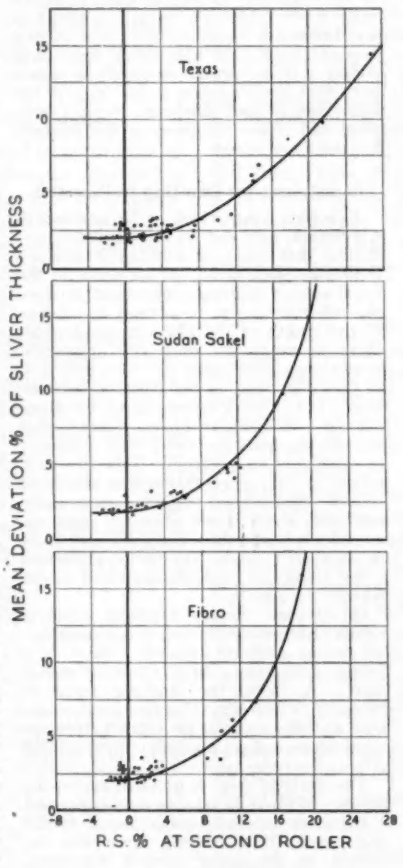

Fig. 2.

Drafting and Yarn Regularity

It is generally known that drafting has the effect of increasing the irregularity of the material drafted. This is because drafting systems are not perfect and do not merely attentuate the roving. However, it is not always clearly realised just why the effect arises. Even if it is accepted that any actual drafting system does not leave the fibre arrangement in the roving undisturbed, it is not obvious that this must necessarily result in an increase in irregularity and the question merits further discussion.

If we could start with a perfect sliver— of zero irregularity— then ideal drafting would produce a thinner, but still regular, yarn. A sliver of zero irregularity would have exactly the same number of fibres at any cross-section. In practice, such a sliver seems to be unattainable and the best we can hope for is a sliver in which the fibres are randomly arranged. In such a sliver the probability, p, of finding a given fibre at a particular place in the yarn is constant (and, of course, very small). Under these circumstances it can be shown that the number of fibres at any cross-section of the yarn is not constant but is distributed with a Poisson distribution, the variance being, therefore equal to the mean. Thus the coefficient of variation of a purely random roving would be $100/\sqrt{n}$, where n is the mean number of fibres in the cross-section. For a 0·12 hank sliver of Texas cotton, this is about 0·6%.

If this sliver were drafted in ideal conditions into 30s yarn the coefficient of variation would be about 9·5%—an increase of more than 15 times. In practice the coefficients of variation of actual slivers and yarns of this cotton might be about 5% and about 25%, respectively— an increase of only five times as a result of drafting.

But it must not be concluded from these figures that the effect of imperfect drafting on real slivers is to make them approach more nearly to the random yarn. The coefficient of variation of the yarn produced by perfect drafting of the actual sliver would be only a little greater than

$$\sqrt{(4)^2 - (0{\cdot}6)^2 + \frac{30}{0{\cdot}12}(0{\cdot}6)^2} = 10{\cdot}3\%$$

That part of the total irregularity not associated with random fibre arrangement would not (except in special circumstances) be increased much by ideal drafting. The difference between 10·3% and the actual 25% is the result of irregularity added during drafting.

If the fibres were all of the same length and were all perfectly straight it might be possible, by making the roller setting exactly equal to the fibre length, to achieve this aim. This case is, however, only of academic importance since in practice, either because the fibres are not all of the same length or because they cannot be perfectly straight, the roller setting is always greater than the length of most of the fibres, since it must not be less than the length of the longest fibres. As a result there is, for most of the fibres, a short interval of time during which they are

not under the direct control of either back or front rollers. It is the motion of the fibres in this uncontrolled time that is responsible for the added irregularity during drafting.

Making the simplest possible assumption about inter-fibre friction, namely that the coefficient of friction is unaffected by relative speed, it can be shown that a floating fibre can move at one of two speeds only—those of fibres gripped by either the front or the back rollers. The mass of a fibre is so small that a free fibre moving at an intermediate speed, and acted upon by frictional forces as a result of its contacts with the two sets of fibres gripped by the rollers, would receive a very large acceleration from the greater set of forces and would very quickly take up the corresponding speed. However, for many fibres the coefficient of friction increases with speed and under these circumstances it can be shown that, at normal drafting speeds, fibres not only can but would be expected to take up intermediate speeds.

Some recent observations of fibre movement in roller and apron drafting show that even at low speeds, when the floating fibres do move only at front or back roller speed, they have an effective intermediate speed (which seems to be remarkably constant) over their floating time (Fig. 3). It seems

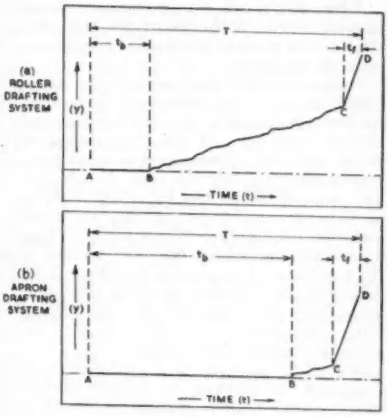

Fig. 3.

reasonable, then, that the usual two-speed model of drafting behaviour is too simple and that a more realistic model would include an intermediate speed for the floating fibres.

There are many ways of considering the irregularity introduced by the movement of the floating fibres and it is not usually possible to relate these to each other. The simplest argument is based on the assumption that the number of floating fibres accelerated to front roller speed is roughly proportional to the number of fibres gripped by the front rollers. But if floating fibres are pulled forward in this way a thick place is formed in the drafted sliver and a thin place in the drafting zone. When this thin place begins to reach the front rollers, the number of floating fibres being dragged forward decreases because there are now fewer fast-moving fibres to drag them forward. Consequently, a thick place forms between the rollers, which in turn reaches the front rollers and so the process repeats itself. The quasi-periodic character of the irregularity thus introduced into the drafted material has led to its being given the name of a drafting wave.

An interesting speculation on a process of this kind concerns the question as to whether, if the ingoing sliver were uniform, a drafting wave would ever start to form at all.

There is plenty of experimental evidence for the existence of the drafting wave. Mathematical explanations of its formation are available too, based either on statistical considerations of the number of fibres moving at front- or back-roller speed (Foster) or on the forces acting on the fibres in drafting (Cox). However, both types of argument are based upon very broad assumptions which are certainly not wholly true. Other theories of drafting do not lead to the development of a drafting wave (Grishin, Grosberg, Burnett).

So far as I am aware only one attempt has been made to formulate mathematically the conditions that must be fulfilled if the movement of the floating fibres is to be regularised, and this is based upon some very dubious assumptions. It is clear that some form of control of floating fibres is necessary and it is possible to indicate in general terms the form this should take. The longest fibres in the sliver will travel at back roller speed until their leading ends reach the front roller nip, i.e. for almost the whole of the time spent by their leading ends in the drafting zone. If the fibre arrangement in the ingoing material is to be preserved then clearly all fibres must behave in this way. They must be constrained to move at back roller speed for as long as possible. In most cross-sections of the roving there are more fibres gripped by the back rollers than there are fibres gripped by the front rollers so that the natural tendency will be for a floating fibre to be held by the back fibres and for it to move at their speed. If control is to be maintained the floating fibres must be kept closely in contact with the back-roller fibres between the back-roller nip and a point in the drafting zone distant the length of the shortest fibre from the front rollers. On the other hand the pressure with which fibres are in contact must not be so great that front roller fibres cannot slide relative to the back roller fibres. In practice, attempts to achieve the necessary pressure include the use of condensers to compact the roving, and aprons or other moving devices.

It should perhaps be noted that twist, which produces a lateral pressure from an applied longitudinal pull (the drafting force) applies pressure in the wrong place for control in roller or apron drafting. The twist tends to run into the thin parts of the material immediately behind the front rollers and excessive pressure here can be harmful in locking together front and back roller fibres. In mule drafting, of course, the control exerted by twist is beneficial in that it causes thick places to be drafted preferentially.

The objectives of a fibre control system should, therefore, be to maintain the correct amount of pressure on the fibres until they get near to the front rollers, and to restrain the tendency of the twist in the drafting zone to run into the region immediately behind the front rollers.

It would be interesting to know the extent to which the various fibre control systems—aprons, condensers, carrier rollers, etc.—fulfil these requirements. The effect of failure in either respect is much the same—fibres are brought to the front roller nip out of turn: the thickness distribution in the drafting zone is therefore disturbed and so the twist and pressure distributions are altered. These in turn affect the fibre behaviour. Although modern drafting systems do achieve very good fibre control, this is by no means perfect and there is plenty of room left for improvement.

Doubling

Although not strictly connected with drafting, the practice of reducing irregularity by doubling is so intimately associated with it that it should be mentioned here. It is usually assumed that by doubling together n similar rovings or slivers the irregularity of the resultant is reduced to $1/\sqrt{n}$ of the irregularity of each. Strictly, this is true only if the irregularity concerned is caused by random arrangement of fibres. If this condition is not fulfilled—and, as we have seen, only a small part of the irregularity of many slivers is associated with random fibre arrangement—then although the average irregularity of the resultant is approximately $1/\sqrt{n}$ of that of the original slivers, parts of the resultant sliver may be just as irregular as the originals.

This is most easily seen by supposing the irregularity to take the form of a sinusoidal thickness wave. The effect of putting together two rovings with this kind of irregularity depends upon the phase relationship between the waves in the components. If they are out of phase the resultant irregularity is zero: if they are exactly in phase it is just the same as in the separate components. In practice, although the result will nearly always be somewhere between these two extremes and the average amplitude is reduced by doubling, the components can be combined in such a way that the amplitude is unchanged. At first sight it might appear that the average amplitude of the wave in the doubled roving would be one-half of that in each individual roving but unfortunately this is not so. The probability of the doubled material being bad is considerably higher than that of its being good and the average amplitude after doubling is appreciably greater than one-half of the original amplitude. The argument can be extended to two and three doublings, with the result shown in Fig. 4. Note that with three doublings (eight components) the average amplitude is 0·37 compared with $1/\sqrt{8} = 0{\cdot}35$. Parts of the resultant, however, have an amplitude of more than 0·6, so that doubling is not a reliable way of disguising periodic thickness variations of this kind.

Similar arguments must apply to irregularity of a drafting-wave character and although it may be reasonable to assume the $1/\sqrt{n}$ rule for the average effect of doubling, it must always be realised that some parts of the resultant sliver will have appreciably more irregularity than would be indicated by this rule.

Mechanical Imperfections

Let us now return to our original equation, which I said was true only when certain conditions were fulfilled. One of these was that the equation should refer only to average values over some period of time. One reason for this condition being necessary is that the irregularities of the movement of the floating fibres must be averaged out. But another reason is that, unless the rollers are perfectly true and

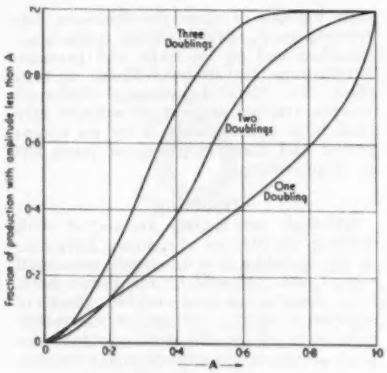

Fig. 4.

uniform, and are caused to rotate uniformly, and there is adequate grip at the roller nips, then the effective surface speeds of the rollers are not constant although, again, they are approximately so when averaged over a suitable period of time.

In practice rollers are not completely uniform and do not rotate in a completely uniform manner. The R.H.S. of our equation is not constant but varies with time so that the instantaneous thickness of the drafted product, even if floating fibres are perfectly controlled, is not constant but also varies with time. The mechanical deficiencies in the roller drive thus lead to yarn imperfections. These mechanical defects are conveniently considered under two headings:—

(*a*) Those affecting the relative position of the roller nips.

(*b*) Those affecting the effective surface speed of the rollers.

(The two groups are not completely independent.)

(*a*) Although the construction of most drafting systems ensures that the average separation of the back and front roller nips remains constant, the rollers themselves are rarely sufficiently accurate for there to be no movement of one or other nip, this movement usually repeating each revolution of the offending roller. Roller nip movement affects drafting because it influences the rate at which fibres are presented to and removed by the front rollers. It is the rate of nip movement that is important, not its extent although the two are, of course, related. Whilst a front-roller nip is moving backwards, for example, the speed with which back-roller fibres approach the nip is effectively increased, whilst the speed with which front-roller fibres are withdrawn is reduced. The effective draft is therefore reduced whilst the nip is moving backwards and a thick place is formed in the yarn. But since the average nip position remains constant, the nip must move forwards as well as backwards on each revolution so that thin places are also formed. The separation of successive thick or thin places is equal to the roller circumference.

It is easy to show that movement of a back-roller nip is relatively unimportant—the amplitude in the yarn is proportional to (1 - 1/D): movement of a front roller nip, however, produces an amplitude in the yarn proportional to (D - 1) and to the extent of the nip movement. The effect is therefore particularly important when high drafts are used in any zone.

There is a long list of causes of roller nip movement, the most important being:—

(i) Eccentric rollers.
(ii) Non-uniform compressibility of roller coverings.
(iii) Distorted or worn rollers.
(iv) Interaction between bosses.
(v) Friction in cap bar nebs or top arms.
(vi) Lack of alignment between top and bottom rollers.

(*b*) Again, the method of driving drafting rollers usually ensures that the mean speed of the bottom rollers is constant: there may nevertheless be variations in the instantaneous roller speeds which affect the rate at which fibres are presented to or removed by the front rollers.

The possible causes of roller speed variations are:—

(i) Eccentric bottom rollers.

The effective surface speed of the roller will vary during each revolution if the roller is eccentric. The effect of this speed variation on drafting is much less than the effect of the nip movement resulting from eccentricity.

(ii) Short-period speed changes caused by roller vibration, gear tooth impact or incorrectly mounted gears and bearings.

It is not easy to design a gear drive that is completely free from speed variation but quite ordinary plain gears, correctly set and mounted, can be arranged to give a roller speed that is virtually free from gear-tooth variations. On the other hand incorrectly set or worn gears, or worn bearings will very often result in a roller drive in which there are small variations of speed corresponding to the impact of the gear teeth. In themselves these are not usually serious: trouble does arise, however, when the frequency of these impacts corresponds with the natural frequency of torsional vibration of the roller. When this happens the extent of the speed variation can become very serious: the roller speed may alternate between zero and twice its normal speed, and, of course, the draft will vary in a corresponding way. However, the frequency of such large amplitude speed variations—the frequency of roller vibration—is usually so great that although this varying draft affects the arrangement of fibre leading ends, the wavelength is so small compared with the fibre length that no marked effect is found on yarn thickness until a sufficiently great following draft has been applied.

Frictional behaviour in roller bearings of the so-called "stick-slip" variety can stimulate roller vibration at the natural frequency of the roller without the need for the stimulus of gear tooth impacts.

As with the defects produced by nip movement, those caused by roller speed variations are strictly periodic. Thick and thin places occur at strictly regular intervals and they can, when the yarn is used as weft, have a damaging effect on fabric appearance out of all proportion to their amplitude in the yarn. A periodic thickness variation large enough to spoil a dress or curtain fabric, for example, may have a negligible effect on the total irregularity of the yarn.

(iii) Roller slip.

It has already been explained that, unless the grip on the fibres at the roller nips is sufficiently great, there will be slip between fibres and roller instead of the fibre-fibre slippage that is desired. When slip of this kind occurs thick places are formed in the sliver. Although caused by a mechanical defect—insufficient weighting or too close a roller setting, for example—the yarn faults caused by roller slip are not strictly periodic although they do have an intermittent character.

The effects of nip movement being approximately proportional to the zone draft are, in present practice, of importance only on ringframes.

Roller speed differences of the roller vibration type are important on speedframes particularly; this is because the natural frequency of the long rollers of these machines is low enough to put a large amplitude wave into the fibre distribution and because there is a following draft to develop this wave into a yarn thickness variation. Ringframe rollers, being as long as speedframe rollers can also vibrate at the right sort of frequency but there is no following draft here to develop the latent irregularity so produced, but drawframe rollers can sometimes vibrate and cause irregular yarn to be produced.

Roller slip is essentially a phenomenon found on drawframes or similar frames where a large bulk of material is handled.

B.A.Q.C.T. Conference

Control of Quality

By W. ATHERTON

QUALITY control and research and development functions are closely related, particularly in mills where they are often contained in the same department. To some extent this is to be expected, but as the laboratory usually also deals with such work as customer's complaints and requests for assistance in solving problems, testing samples received and submitted, and performs many other related and unrelated tasks, there is a danger that quality control will receive less attention than it should. The routine nature of quality control is less attractive than other work, which has novelty as well as an immediately apparent effect. Someone is usually waiting for the result, whereas most quality control testing is negative, i.e., no action is required further than reporting the result.

It is necessary, therefore, to plan the routine testing in such a way that no flood of other work, and no reasonable amount of absenteeism among laboratory staff will prevent its being carried out. A prerequisite of this is for its importance to be understood by the assistants carrying out

A paper given at the recent conference "Drafting and Yarn Quality," organised by the British Association for Quality Control

the tests, and the consequences if the tests are neglected, also there can be nothing more frustrating than work carried out but not inspected. The only measure of the value of the work performed, whether in the mill or in the laboratory, is the reaction of the man in charge of the department. If he is indifferent, or too occupied with other duties, the work will be done indifferently and will eventually degenerate into just another way of getting time over.

In some mills, useful time wasted in carrying out daily strength tests, could be more usefully spent inside the mill carrying out tests to improve yarn regularity. Tests for count and strength are very necessary but their value can be overrated, and can in fact become an obsession. A quality control department usually starts with count control, but too often it stops there, instead of becoming only a small part of the laboratory function once a satisfactory system has been put into operation.

Yarn evenness has, of course, always been the aim of spinners, but only in comparatively recent years have instruments been generally available for measuring evenness. In 1953, Shirley Institute issued "Tables of Irregularities" as targets to be aimed at. These were useful guides, and still are, but the general opinion is that, although they were applicable at the time, the position has since improved, and the figures should be reduced by about one fifth. If that is so, it is to the credit of the spinners, but many short and medium staple spinners would be satisfied if *all* their results fell below the 1953 maximum. More than 20 years ago the same body issued a table of bobbin to bobbin variation. It would be interesting to see the result of a similar survey at present.

Before passing on to organisation of methods of minimising yarn irregularity, it is felt appropriate to refer to cotton selection and mixing. If some of the cotton mixings put down nowadays were submitted as answers to a first year textile examination question, they would get no marks at all. The price is very important but the cost, at later stages of mixing long and short, coarse and fine, fibres, and of mixing cottons of quite different characteristics, is seldom considered. Spinners would have fewer drafting difficulties if greater care were taken with cotton selection. In periods of demand, standards departments have need to rigidly maintain their standards; irregularities appear in the trade, of a nature quite different from those caused by defective drafting. The manufacturer gets his supplies from a greater number of spinners, and the spinner who keeps his cotton stocks too low can seldom be assured of a constant supply of the cotton he normally uses, even if he is prepared to pay a premium for it, and the spot lot to tide him over can lead to difficulties in drafting. In these and similar circumstances there is little the quality controller can do other than accept them with a bad grace.

Quality control has been well defined as an effective system for co-ordinating the quality maintenance and quality improvement efforts of the various departments in an organisation, so as to produce at the most economic levels which allow for full consumer satisfaction. To fulfil this aim efficiently, it is necessary for the function and responsibility of each department to be clearly defined, and understood by the head of each department. The departments concerned in most spinning mills are cardroom, spinning room, and laboratory. A few enlightened mills make the engineering section responsible for periodic overhaul of machines. Where this is the case, they probably play the most important part in quality maintenance.

The functions of cardroom and spinning room are much more clear than those of the laboratory, which is usually concerned in some way with every section of the firm. If a man applies for a position as carder or spinning overlooker, he knows fairly well what is expected of him, what he can expect, and what his status will be. But the position of "head of laboratory" or any other of the euphemistic descriptions for that position, is difficult to define. Even when the responsibilities are fairly clear, whatever the department, its efficiency reflects the ability and temperament of the man in charge. This, of course, is not limited to carders, spinning overlookers, and heads of laboratories! This does seem to be the wrong way round. It is difficult to alter personalities; and fortunately nothing more than a passing reference is called for here. But if each member of mill management would attempt to engage an immediate assistant who is potentially better than himself, and see that he received adequate training, for which facilities are now available, it would be a considerable step in the right direction.

Essentials in the Control Scheme

Papers given at previous conferences have drawn attention to the misleading description "quality controller" often given to the head of the laboratory. A description receiving some support is "quality analyst." This does define a little more exactly the duties of the laboratory staff, implying that their job is to test and report only, and to take no part in control by applying effective measures for correcting defects; that all such action is the responsibility of management. This is not wholly acceptable, however. The control of hank and count should unquestionably be the responsibility of the laboratory. There may still be carders who insist on doing their own drawframe wrapping. Surely their time could be more usefully occupied in general supervision. A laboratory assistant wraps drawframes just as efficiently and the decisions to change draft wheels or not, are likely to be more often right if based on control charts or calculated limits. It is not a question of taking away some of the carder's authority. It is simply making better use of his time and experience in his other duties.

In the matter of control of short-term irregularity, the description "quality analyst" is a good one. Here his main responsibility is to discover defects, report and suggest if necessary, remedies for eliminating them. The final decision of what steps are necessary should rest with management. Few laboratory-trained personnel have the necessary technical knowledge and mill experience to say exactly what is required. Even where they have this knowledge, corrective action often means interfering with production and that is entirely the responsibility of management. With a continuous quality control programme, defects are rarely to bad as to warrant stopping a frame for long periods. Unfortunately, even when variation is unusually high, the frame continues to produce, if at all possible, and as long as the tenter does not complain. The reason for this may be that there is a reluctance on the part of management to believe that the sliver can be as far from normal as the evenness tester indicates. Everyone can understand measuring and weighing lengths of sliver, but it is also understandable that figures from a regularity tester, even when accompanied by a chart, are sometimes accepted without agreement. One simple, if rather laborious, method of convincing sceptical colleagues, is to process into yarn a good sliver and a bad sliver, and compare blackboards of the two yarns and test their single thread strength. A demonstration of this kind can be most effective, whether regarded as an incentive to produce good work, or a deterrent against bad work.

The arrangement of work within the laboratory will depend largely on whether it is thought better that each assistant should be responsible for a particular type of work, or whether all assistants should be trained in all jobs. The size and structure of the organisation will also be a determining factor. Provided the methods of sampling and testing have been laid down and assistants trained to follow the same procedure, there is no reason for any observer differences in testing sliver, roving and yarns for regularity, and it certainly does not call for a high degree of skill. As the work can become rather monotonous, probably the most satisfactory system is to train all or most assistants to carry out these tests, and to draw up a rota, say, half a day, as a stint. The rota system can be applied to many of the routine tests carried out in spinning mills. It enables the bulk of the work to go on without frequent direction, and in a busy laboratory it prevents the head from becoming like a policeman on point duty. A control system consists of three main functions:—

(1) Setting standards.
(2) Appraising for conformance to standards.
(3) Initiating and carrying out corrective action.

For sliver or roving regularity, standards should be agreed between the manager, carder, and head of laboratory, and should be reviewed from time to time. Appraising for conformance to standards is a laboratory job. Initiating and carrying out corrective action is a combined operation, and it is usually the most difficult of the three. This difficulty does not arise because there is divided responsibility. It was pointed out earlier that in controlling regularity, the laboratory reports results, and the carder carries out the necessary adjustment. The difficulty arises in the method of reporting, and in deciding what are the necessary adjustments. For the control of hank at the drawframe, it is a simple matter for the laboratory to issue a note to the carder to change a drawframe from 100 to 99 crown wheel. It is not so straightforward to change the regularity from say 5 to 4½, or whatever the limits may be. But a similar note, giving the result, and accompanied by the chart, can be sent to the carder. The chart may be a source of argument, but the figure and chart together will be a guide to the seriousness of the fault, and may give him some idea of what is causing it. A verbal message is not sufficient. Results outside the agreed limit should be reported immediately they are obtained.

Testing has been described as laboratory work because it is done by laboratory staff. But it need not be carried out in the laboratory, especially if the laboratory is

some distance from the mill. If a convenient spot can be found in the card room, tests can be carried out there. In addition to saving time spent in carrying samples to the laboratory, this has the advantage of avoiding possible changes in moisture content, saves time which might be spent in taking precautions against moisture changes, and must reduce the danger of excessive handling. There is a reduction in the time lag between sampling and reporting, a most important feature in such a highly productive machine, and the operatives would probably take a greater interest in the pursuit of regularity. If the cause of irregularity is neglected cleaning, it would be some incentive to the operative to correct this, especially if the machine has to be stopped for a time when excessive irregularities are shown to be present. This would not, of course, increase the laboratory assistant's popularity in the card room, also testing in the mill is not practicable where the evenness testing instrument is not readily portable. But it is a method worth considering where it can be conveniently applied.

After measures have been taken to correct a drafting defect, the frame should be resampled as soon as possible to check whether the adjustment has been effective. If the tests are done in the card room, the laboratory assistant is on the spot for re-testing. If the tests are done in the laboratory, the carder will probably notify the laboratory as soon as re-testing can be carried out. But the onus of following up and re-testing must rest with the laboratory, as a service department. The risk of becoming a nuisance by enquiring too soon or too frequently whether corrective action has been taken, is a worthwhile risk.

This method of follow-up, while lacking precision in detail, works quite satisfactorily. The important point to make clear is who shall be responsible for each stage, from the first sampling to the point when conformity to standard has been regained, and reported. Any kind of divided responsibility is a constant source of irritation, and must lead to inefficiency. If the introduction of laboratory testing creates lasting friction, it will also create more problems than it solves. Also, if the increasing reliance on instrumentation leads to relaxed vigilance on the part of supervisory staff, and the feeling is engendered that quality is no longer their responsibility, much harm will be done. Instruments cannot replace some of the technical skill and knowledge accumulated over years of experience. But they do bring new knowledge, and quite often help to dispel some of the home-made and firmly held beliefs which also pass for experience. Where evenness testing instruments have been introduced, management is seldom satisfied that sliver or roving is right because it looks right. A carder can often get some indication of the variation in slubbing by observing the degree of "ridginess" of the bobbins, but he is happier when this is confirmed by testing, even if he demurs when it isn't confirmed.

Laboratories have sometimes been installed with the object of keeping supervisory staff on their toes, and in some cases the supervisory staff adopts the attitude that if the laboratory doesn't find anything wrong, everything is all right, or no news is good news. Both these concepts are wrong, or at least, cannot be wholly accepted, either in principle or in fact. The laboratory exists as a service to production, to report on the quality of what is being produced, and to suggest improvements. Perhaps not a very humble servant, for it naturally becomes restless, and perhaps militant, when its recommendations are not accepted, and no satisfactory reason is given. Such a situation is not common, but it does arise and must be dealt with, whether the reasons for not taking corrective action is that the carder or overlooker has not the time, or whether his leadership of the department is inadequate and ineffective. If there is no routine provision for reporting to higher management, a special case must be made. This is a punitive action, and is not likely to be welcomed by higher management if there is any doubt concerning the result. The laboratory must be sure of its ground. The consequences of failure are loss of confidence by management, and the creation of bad feeling. This will not occur if, as it must, the laboratory has a reputation for being right, without becoming unbearable about it.

The introduction of improved methods may sometimes be resisted by overlookers and managers, because their acceptance may need increased maintenance staff, new and costly equipment, and a much more frequent renewal of worn parts. There is still a great deal of pre-war parsimony as regards spares. This is false economy, and the make-do and mend attitude, commendable in many instances, is often carried too far. But many overlookers and managers have been trained to change a part only when the frame will not run, and the standard of what is acceptable is often far too low. Re-equipment with machines of a much higher engineering standard than in the past will not solve the problem of inadequate maintenance. Their high rate of productivity could intensify it, if maintenance men have not been trained to a sufficiently high standard.

Planned Maintenance Schedules

Any system of quality control attempting to function without a planned maintenance system carries a considerable handicap. Quality depends very largely upon the condition of machines, which in turn depend on the technical skill of those responsible for maintenance. Ideally, the required technical condition of machines can only be maintained by taking them out of production periodically for a complete overhaul. With the reduction in the number of machines likely to be required in the future, because of their high rate of productivity, and because of their cost, and of the space taken up by them, having a spare preparation throughout the mill is too expensive to contemplate. But considering the amount of machinery which has been out of production for years in almost every mill, it is surprising that a separate system of overhauling machines has not been established in all those mills in addition to routine maintenance. Where such a system has been in operation, it was found to be well worth while. The engineering section should be responsible for this work, and of course, this incurs expenditure on adequate tools, equipment and space. As much obsolescent machinery is likely to be still running for many years yet, the system of completely overhauling machines will help to bridge the gap between the quality of their production and that of new machinery.

Routine maintenance systems in mills vary tremendously, from the purely nominal to the carefully planned and rigidly observed. Some drafting systems need more attention than others, but where there is more than one type in a mill they often all run the same length of time before scouring, and the time is usually counted in weeks, irrespective of the hanks or weight passed through, or the type of material processed. Scouring is, understandably, often done at week-ends and sometimes while the mill is stopped at mid-day. In addition to making up the wages of the scourers, it avoids loss of production. But there is in this practice a danger of inadequate supervision. Management should see that there is someone present with sufficient authority to supervise the work, to check that wheels are in a satisfactory condition, and that they are geared correctly before starting up.

As with frequency of sampling for testing, frequency of scouring varies widely from mill to mill. Perhaps it would be too much to suggest that it is the number of frames in a department divided by the number of week-ends available, but quite seriously, it is questionable whether the frequency is determined by need, but rather that a practice was commended years ago, and it has not been felt necessary to review it. This is not surprising. It would be difficult to establish a scouring cycle based on quality and to determine the degree of deterioration in quality throughout such a cycle. If this were attempted, machine damage would probably be the measurable character, and a complete stoppage of the frame or possibly a fire might indicate that the cycle was complete. If this matter has been treated more seriously elsewhere, it would be very interesting to learn the result of the investigations, and if it is found that quality does fall off between one scouring and the next, it would give some useful information, not only on the length of the cycle, but on the order of scouring throughout a preparation.

Whatever the system of scouring or other maintenance to the drafting arrangement, immediately the frame is back in production the roller vibration detector should be used to check that vibration is at a minimum, and samples should be taken for evenness testing. It is far more important to check frames immediately after maintenance work has been carried out than at any other time. It is often said that more damage is done by re-setting frames than by leaving them alone. This statement may not be strictly correct, but there is some truth in it, and the reason for making it can be understood.

In order that the necessary maintenance and checking shall be effectively carried out, a scheme of maintenance should be drawn up by management, and written instructions in detail issued to heads of departments. The laboratory should be given a copy, with particular reference to *when* the maintenance will be carried out. Mutual understanding and verbal messages between departments are admirable in principle, but if no definite plan is laid down misunderstanding and unnecessary deviations will creep in.

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TROPICAL SCIENCE. A recent edition of the quarterly journal of the Tropical Products Institute contains a thorough tract on Experiments in the Cultivation, Harvesting and Retting of Jute in British Guinea by M. D. French-Mullen.

Technical Literature

POWERGRIP TIMING BELT DRIVES. Packed with easily assimilable information, a new handbook from Crofts (Engineers) Ltd., Bradford, Yorks., provides a wealth of data concerning Powergrip ½ in. heavy duty timing belt drives. Quiet in operation, with positive sheer resistant, non-slip teeth, the belt is made from durable neoprene, bonded to the steel cable load carrying members. A tough nylon-faced fabric provides a wear-resistant surface for the contact face of the belt. A second catalogue, also available, features combined spur and worm double reduction gear units. A range covering powers up to 60 h.p. at ratios from 300 : 1, h.p. rating tables are included together with dimensions of the various types.

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ACETIC ACID. Arranged in an extremely logical manner, a new booklet released by the Distillers Co. Ltd., Devonshire House, Mayfair Place, Piccadilly, London, W.1, is concerned with the storage and handling of bulk supplies of acetic acid. It deals with materials for storage vessels and piping, insulation, gauging and venting of tanks, pipelines, pumps, valves, safety precautions, etc. A limited number of copies are available for distribution.

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ANALYSIS OF FATTY ACIDS AND ALCOHOLS. Technical Publication No. 6 issued by Prices (Bromborough) Ltd., Bromborough Pool, New Ferry, near Birkenhead, deals in a most comprehensive manner with aspects of the analysis of fatty acids and fatty alcohols. It is based on the company's long experience in this specific field, and has been brought right up to date by the inclusion of a section on gas chromatographic and U.V. spectrophotometric techniques as applied to fatty acids and fatty alcohols. Over half the publication has been allocated to detailed test procedures set out in such a manner as to be of the maximum assistance to laboratory staff in their work.

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NEW MONORAIL HANDLING SYSTEM BOOKLET. A new illustrated handbook published by British MonoRail Ltd., Wakefield Road, Brighouse, Yorks, shows ways in which the system is applied to cater for different industrial requirements. The booklet describes the standard precision parts comprising the system, and which can now be used to provide minimum-headroom underslung cranes with capacities of up to 5 tons, and, because the crane rails can be supported from the roof, of virtually unlimited span. A series of case histories demonstrates how the British MonoRail system has been applied to solve a variety of transportation problems in factories.

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SCIENTIFIC INSTRUMENTS. The latest edition of the well-known catalogue published by W. G. Pye and Co. Ltd., Granta Works, Cambridge, describes several important new developments to interest all concerned with scientific research or industrial production testing and process control. Catalogue "N", distinguished by an orange cover, supersedes all previous editions which should now be destroyed. Copies can be obtained free on application.

SAMSON ADHESIVES. A comprehensive range of Samson adhesives is listed in Publication No. 5/7, now available from Samuel Jones and Co. Ltd., New Bridge Street, London, E.C.4. Glues, pastes, mucilages and synthetic resins are all included.

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MANAGEMENT VIEWS. A recent edition of this quarterly by Remington Rand Ltd., Commonwealth House, 1-19 New Oxford Street, London, W.C.1, contains articles emphasising the value of systemised office routine to several companies. A review of automatic card filing systems is extremely interesting.

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TIOXIDE TITANIUM PIGMENTS. British Titan Products Co. Ltd., 10 Stratton Street, London, W.1, have just released a specification folder for all grades of Anatase and Rutile titanium pigments. Eight are included and special properties and suggested applications are listed.

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CUMBERNAULD—NEW INDUSTRIAL TOWN. The object of a brochure from the Cumbernauld Development Corporation, Cumbernauld, by Glasgow, is to bring the vast and varied industrial potential of Cumbernauld New Town, to the notice of the industrialist. The information about this vast project is given in an easily understood manner, details of labour available, types of industrial premises and the town's location are fully covered.

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HYDRAULIC ACTUATOR. A new brochure announcing a vibration proof, self-lubricating hydraulic actuator is available from Armstrong Patents Co. Ltd., Beverley, Yorks. Giving a positive two-way action with power relative to the load applied when built into an appropriate hydraulic circuit, the actuator can be used to put pressure into a hydraulic circuit or as a means of transmitting the pressure as motive power.

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WORLD OF MEANING. A 98-page book published by S. Smith and Sons (England) Ltd., Cricklewood, London, N.W.2, gives some insight into the scope of the work in progress. Divided into three parts, the first surveys the principal fields of activity to which Smith's knowledge, ideas and specialised workmanship are making an increased contribution. The second covers research and technological training, and the final section summarises the many specialities manufactured by the company.

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PRODUCTION ENGINEERING. Commemorating 25 years of development this jubilee booklet from Production Engineering Ltd., 12 Grosvenor Place, London, S.W.1, traces the company's history from 1934 to the present. Of particular interest to textiles is a brief description of the Musgrave mill experiment. Intended primarily to show the textile industries the advantages obtainable from labour redeployment, the experiment led to a substantial production increase at less cost.

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VARIABLE SPEED DRIVES. Modern production methods have created an increasing demand for variable speed drives, suitable for operation from an a.c. supply, and requiring little or no maintenance. A brochure from Lancashire Dynamo Nevelin Ltd., Hurst Green, Oxted, Surrey, describes just such a range of speed drives. Known as the "Varimag," these are designed to give precision performance with instant starting at any speed.

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ENZYMATIC DATA. A new booklet compiled by Globe Products (Accrington) Ltd., District Bank Chambers, Accrington, Lancs., in conjunction with Novo Industri A/S., Copenhagen, will be of considerable interest to chemists in many fields of industry. It gives information, illustrated by graphs, on the activity and stability of many types of enzymes under various pH values and temperatures, also details of recognised methods of enzyme evaluations. Mention is made of the chemical properties of each preparation and of the possibilities for its application.

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HEAT EXCHANGERS. A new folder—E126b—on the B.B.A. "Rosenblad" plate heat exchanger which is handled in the U.K. by British Boiler Accessories Ltd., 62-3 Fenchurch Street, London, E.C.3, gives concise information with illustrations of some of the special features. Its plate design enables high pressures up to 210 p.s.i. to be used on the stand unit. This heat exchanger can be supplied in most materials including stainless steel, monel metal, titanium and hard lead. The joints are made up from an extruded rectangular shaped nitryl rubber. Basically, the B.B.A. "Rosenblad" plate heat exchanger has been designed with particular reference to the chemical and general manufacturing industries. B.B.A. will also undertake the supply and part manufacture of the remainder of "Rosenblad" heat exchangers excluding the "Rosenblad" spiral.

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AIR, FUME AND GAS TREATMENT. Leaflet No. V59(1) entitled "Incandescent Gas Atmospheres Division—What we Make" is the first of a series to be issued by Incandescent Heat Co. Ltd., Cornwall Road, Smethwick, Birmingham. It deals briefly with air conditioning plant, gas absorbers, acid fume treatment plant, air dryers and preheaters, ammonia dissociators and burners.

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THE CASE FOR COAL. The National Coal Board has published an enlightening and authoritative booklet which sets out to prove that Britain's indigenous fuel can be an economical answer to modern industrialists' fuel needs. Illustrated in colour and in black and white, this useful little work includes sections slanted towards the industrialist, the architect or consulting engineer, works engineer, and local government. The different types of mechanical stoker are defined and described in separate sections, and a final note explains steps taken by the N.C.B. to provide a helpful service for all concerned. Available from N.C.B. (Public Relations Dept.), Hobart House, S.W.1.

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DYEHOUSE INFORMATION. Dyehouse Department, Dyestuffs Division, I.C.I. Ltd.

No. 546—Combining Dyeing and Finishing of Cotton Piece-Goods by the Procion-Resin Process.

Research in Wool Textiles

Organised by the Textile Institute the Second Quinquennial Wool Textile Research Conference, held recently at Harrogate, was international in character. The lecturers and delegates came from all over the world and summaries are given in this issue of the contributions from experts at the Wool Industries Research Association

THE SOLUBILITY OF WOOL IN UREA-BISULPHITE SOLUTIONS

By K. Lees, B.Sc., A.R.I.C., R. V. Peryman, M.Sc.(N.Z.), Ph.D., A.R.I.C., and F. F. Elsworth, B.Sc., Ph.D., A.R.I.C., F.S.D.C.

A FEW years ago a new method for assessing chemical changes in wool during processing was developed by the Wool Industries Research Association. This method, the Urea-Bisulphite Solubility Test, has found wide application both at Torridon and in other laboratories. The method is very sensitive and has proved particularly useful for measuring changes caused by treatment under alkaline conditions, for which existing methods do not give satisfactory results.

Chemical damage to materials such as cotton, rayon, silk and nylon can be assessed by dissolving the fibres and determining the fluidity of the resulting solution. Wool, however, cannot be completely dissolved in any simple solvent, so other methods have to be used. These include solubility tests, in which a known weight of wool is treated in a solution in which it partly dissolves, and the resultant weight loss is determined.

The urea-bisulphite solubility test (hereafter referred to as U.B. test) is of this type. It is particularly useful for assessing the effect of treatment that decreases the solubility of the wool. Thus, the solubility of untreated wool is usually of the order of 40 to 50%, but the solubility can be reduced to 0 by treatment under alkaline conditions, e.g. crabbing, yarn setting and curling. For work on these processes the test has been found most useful, and by means of it the staff at Torridon have solved many day-to-day problems for the industry.

A particularly useful application has been in dyeing. Wool is dyed in conditions that vary from strongly acid to slightly alkaline, according to the type of dyestuff used. The U.B. solubility of wool increases after treatment in acid solutions, and decreases after treatment in neutral and alkaline solutions. Thus dyeing conditions that cause least change in U.B. solubility are least harmful to the wool.

Some wool yarns and fabrics are stabilised by setting, which is usually done by boiling in water or exposure to steam. This treatment decreases the U.B. solubility of the wool, so the test is a very quick and useful way of ascertaining the degree of permanent set imparted by a particular treatment.

The test has also been used for investigating faults occurring during crabbing. Uneven treatment in this process can result in uneven dyeing of the cloth; and it has been shown that there is a relation between U.B. solubility and rate of dyeing.

The Association was able to help members of the industry who, a year or so ago, were experiencing trouble with the curl coming out of curled pile fabrics during dyeing and finishing. Using the U.B. test the Association has shown that it is more difficult to set curl into yarn spun from tops that have been peroxide bleached than into yarn spun from unbleached tops.

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RECENT RESEARCHES IN COMBING

By R. Bownass, B.Sc., A.T.I.

DURING the past decade many investigations have been pursued at Torridon in order to obtain a fuller appreciation of the effect of fibre length distribution and other factors affecting the improvement of efficiency in processing. These investigations have included a study of the combing performance of skin wools, a study of the effects of lubrication on worsted carding, assessment of fibre breakage associated with the Noble comb and a study of the feed of the Noble comb. Little has been published on these topics, and so the results of the investigations recorded in this paper should be of value.

Skin and Fleece Wools Compared

It is well known that skin wools give much higher tears than do comparable fleece wools; the experiments at Torridon were designed to provide an authentic record of the performance of skin wools, particularly as regards fibre breakage and tear. Skin wools contain smaller proportions of short fibres, probably due to the absence of second cuts in shearing, and this is reflected in the higher tear.

The methods of removing wool from the pelt have been compared. The painting method did give some fibre breakage in the actual removal process, but in carding there was little to choose between painted and sweated wool as regards fibre breakage.

A comparison of comb tears showed that sweated wool gave the highest figure, painted wool the next, and fleece wool the lowest. Shrinkage tests on knitted fabrics confirmed the generally accepted opinion that pulled wool felts less than fleece wool.

Fibre Breakage in Worsted Carding and Combing

Investigations with 64s quality wools, both burry and clear, provided some information about the effects of lubrication on fibre breakage during worsted carding. The amount of fatty matter left in the wool after scouring is important if no lubrication is to be added before carding; about 0·6% is the most satisfactory amount—as has been found in practice by the industry. The best conditions are achieved when to this 0·6% an addition of 0·3% of lubricant is made before carding. One finding of particular interest was that if only a small amount of fatty matter (0·3%) is left in the wool after scouring, static electricity effects may be experienced during combing, even though lubricant is added.

Noble Comb

Recent fibre breakage measurements have shown that breakage on the Noble comb is very much less than had previously been thought. Recent investigations at Torridon have shown that variations in feed on the Noble comb, and the consequent variations in production rate, are largely caused by variations of tension in the punch-ball sliver being fed to the comb. An attempt has been made to reduce these effects. A fair degree of regularity has been achieved by controlling the tension.

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THE COMPOSITION OF SUINT

By F. O. Howitt, M.Sc., Ph.D., D.Sc., F.T.I., F.R.I.C., and R. Preston, B.Sc., Ph.D., A.R.I.C.

EVER since 1802 attempts have been made by chemists to find the constituents of suint. This substance, which is to be found on greasy wool, is the product of the sheep's sweat glands together with certain waste products dissolved in it.

The composition of suint has never been precisely determined, and even now our knowledge is incomplete. But the investigations reported in this paper certainly add something to our knowledge and understanding of the subject. In particular, a new series of compounds, not previously detected in suint, has been identified.

The preliminary work was done on commercial samples of Romney Marsh wool. This was followed by the use of Australian Merino wool from sheep that had been kept in pens and whose fleeces had been protected by mackintosh coverings to prevent weathering and contamination of the wool.

Various methods of analysis were used (some specially developed) including partition chromatography, an invention for which a 1952 Nobel Prize was awarded to Dr. Martin and Dr. Synge, who at the time they invented the method, were on the staff of the Wool Industries Research Association.

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SIZE DISTRIBUTION AND CONSTITUTION OF NEPS IN COMBED WORSTED SLIVERS

By S. L. Anderson, M.Sc., F.Inst.P. and Rita Stubbs

A NEP is defined as a small knot of entangled fibres. But how many fibres have to be entangled together for a man in the industry, or in research, to

refer to it as a nep? Clearly, two fibres do not make a nep. Members of the industry examined a large number of neps from slivers at Torridon; there was fairly close agreement amongst them that if the size of the clustered core of fibres is about one-hundredth of an inch in diameter (0·25 mm.) or more it is a nep. This agreement had to be established before the results of research on neps could be of practical use to the industry. The method described in the paper is put forward as an objective means of making a nep determination.

A large number of neps from three tops was examined at Torridon. It was found that the frequencies of occurrence of neps of the various sizes was a decreasing function of the size of the core: in other words, neps of decreasing size were present in increasing numbers. This was true for very neppy tops as well as average ones, so it may be concluded that as a general rule very neppy tops have greater numbers of neps of all sizes. Another finding, suggested by the length distribution of the fibres, was that a large proportion of the fibres in a nep become broken after the nep has been formed.

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AN INVESTIGATION INTO THE STATE OF A WORSTED YARN AT END BREAK

By Joan Adamson, C. Casswell, J. Ingham, and J. B. Sharp

THIS paper was in two parts. Part I dealt with the fibre structure of the yarn in the break region, and Part II with the question "Do the fibres slip or break at an end break?"

Part I.—For these experiments a 64s quality wool was spun from a 2¼-dram/40 yd. roving to its nominal commercial limit of 1/48s count (18·5 Tex). The object of this was to obtain as high an end breakage rate as possible consistent with spinning an even yarn. Measurements of roving thickness, drafting force and yarn thickness and tension were recorded on magnetic tape, which at any instant held information corresponding to the previous 90 secs. of spinning time. When an end broke the spinning frame and the feed of the magnetic tape were automatically stopped.

It was concluded from the recorded data that under normal spinning conditions a yarn breaks at a thin place. With one exception the breaks recorded had occurred between the front roller nip and the guide eye. These thin places in the yarn were probably due either to the out-of-turn movement of the floating fibres, or to there having been a region of low fibre density in the roving. There was no obvious connection between roving thickness and end breaks.

An analysis of the fibre distribution in the region of break indicated that each thin place followed a local falling off in the fibre end density and that the average length of the fibres in the thin place was low. In some of the thin places in the yarn which did not break it is interesting to note that there were long fibres and sometimes fibre entanglement.

Part II.—The question "Do the fibres slip or break at an end break?" was discussed at the first International Wool Conference in Australia in 1955, but it remained unresolved. For this reason and because it is a fundamental in the understanding of spinning the matter has been investigated at Torridon.

The basis of the experiment was to stain the fibres in a roving in such a way that their ends were coloured more deeply than the remainder. Thus from an examination of the fibres at the two ends of a yarn end break it would be possible to identify any that had been broken.

Attempts to stain wool fibres in this way were unsuccessful, but man-made fibres were more easily stained. A 4-in. 3-den. matt "Fibro" was used because its strength is similar to that of wool; unfortunately "Fibro" has a lower interfibre friction than wool, so the behaviour of wool cannot be inferred from the behaviour of "Fibro." The results of the experiment suggested that in six of the seven breaks examined the cause was fibre slippage at a thin place in the yarn.

The behaviour of fibres other than "Fibro" cannot be predicted from the results of this experiment because of differences between them in friction and strength. There is, however, one feature common to all yarns of a fine count, such as 1/48s (18·5 Tex) worsted for example: the strength of most of the fibres is higher than the yarn tension. For fine counts, therefore, it is very probable that the fibres tend to slip before they break.

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THE INFLUENCE OF FIBRE STORAGE ON CLOTH DIMENSIONS AND SOME OBSERVATIONS ON CHANGES DURING FINISHING

By J. Lawes, B.Sc., and M. W. H. Townsend, B.A., F.Inst.P.

TWENTY years ago worsted tops used normally to be stored before drawing; and the resultant roving was stored before being spun into a yarn. Today tops and roving are often processed "red hot" and this has sometimes been regarded as a cause of certain faults and troubles. Recently the shrinkage of fabrics during making-up has been ascribed to this cause, so the matter was investigated at Torridon.

Cloths were woven under identical conditions from yarns that differed only in the times for which the tops had been stored before drawing and the rovings before spinning. All the experiments were made with 64s Australian wool scoured and processed throughout at Torridon. The final measurements of cloth dimensions were made on pieces that had been fully relaxed as a result of two wet treatments. The cloth was a 2/2 twill woven with 52 ends and picks per inch in the loom from nominal 2/28s worsted yarn.

The results of the experiments show that there is little doubt that the storage of tops and roving increases the temporary set in the fibres, that some of this remains during drawing, spinning and weaving, and that its subsequent removal in finishing results in the cloth width and length being less than if the tops and rovings had not been stored.

This conclusion has the following consequences of importance to the cloth finisher. After cloths have been fully relaxed in finishing, they will be a little heavier, tighter and better built if they have been made from stored tops and rovings than if there has been no such storage. The finisher should note, however, that if he aims to produce cloths to a given width or length by introducing temporary set in some finishing operations, finished cloths from stored tops and rovings will shrink more when the temporary set is finally removed than if there has been no storage.

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DISTRIBUTION OF FIBRES ON A WOOLLEN CARD

By P. D. Jowett, B.Sc., and R. T. D. Richards, B.Sc., M.A., A.Inst.P.

GREAT interest has been shown recently in the distribution of fibres on a woollen card and the effects of various factors on this distribution. This paper deals with the delay factor, which is the average time taken by fibres to pass through a part excluding the doffer. Only a small fraction of the fibres on the swift are taken by a worker or the doffer, this amount being known as the collecting fraction. The total loading of fibres within a part is given by the product of the delay factor and the input per swift revolution.

Methods for determining the delay factor are given, the most important being the photo-electric web tester developed at Torridon for the WIRA/LDEP Autocount, used with an electronic integrator specially devised by the Association. As an example, the delay factor in the case of a fillet card with small diameter rollers was found to be around 45 secs., except for the smallest depth of setting (⅛ in.) and the lowest fancy lead (7%).

A comparison of the use of one and two fancies on a Garnett covered single part with three workers revealed that the use of two fancies reduced the swift loading, which is generally considered to improve carding action and production rate. Other findings were that, as found previously, the collecting fractions of workers and doffers had comparatively small values, those for the workers having been less than for the doffers.

Experiments at Torridon on a single-swift fillet clothed carder part with six workers gave the following information:—

(1) Doubling the doffer speed from 2 to 4 r.p.m. reduced the delay factor from 75 to 42 secs.
(2) Reversing the direction of rotation of all six workers reduced the delay factor from 75 to 25 secs.
(3) Replacing the 36-in. doffer by one of 10-in.—the setting and surface speed remaining the same—left the delay factor unchanged at about 58 secs. for both large and small doffers.

An important aspect of the delay factor is that it smooths out irregularities in throughput arising in an earlier part of the card. It follows that any irregularity at the last doffer is serious, there being no subsequent delay factor. For example, fabric faults have been traced to an eccentric doffer on the carder part. Another example was a variation of seven thousandths of an inch in the last swift radius (over the wire) which caused yarn

irregularity of as much as half the mean count. Mule spinning made no noticeable reduction in the amplitude of the variation although the wavelength of the fault was only 8 ins. in the slubbing.

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DIFFUSION OF SOME SULPHONIC ACIDS IN KERATIN IN THE PRESENCE OF WATER AND ALCOHOLS

By J. A. Medley, M.Sc., and D. K. Ramsden

IN order to add to our knowledge of the absorption of dyestuffs by wool, fundamental studies have to be made of the speed and mobility with which certain constituent parts of dyestuffs can diffuse into the wool substance. For various reasons such investigations cannot be made satisfactorily by means of experiments with the normal dyeing process. Nor can wool itself be conveniently used in these laboratory experiments; horn keratin, which is chemically similar to wool is found to be preferable.

Radioactive technique is used in this work, the substances being "labelled" with a sulphur radioisotope so that their progress as they diffuse into the horn keratin can be followed and measured. The effects of systematic alteration of the size and shape of the diffusing molecules have been studied, and also the acceleration due to the addition of sparingly soluble alcohols.

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AN INVESTIGATION OF THE SULPHUR COMPOUNDS IN ACID HYDROLYSATES OF WOOL

By Barbara Lewis, B.Sc., A. Robson, B.Sc., Ph.D., A.R.I.C., and Eva M. Tiler

CAREFUL analyses made in the past have failed to account for wool sulphur in terms of the three sulphur-containing amino acids, cystine, methionine and cysteine. Analyses of wool labelled with the radioactive isotope ^{35}S by a combination of radiochemical and chromatographic methods have shown that considerable breakdown of cystine occurs during the dissolution of wool in acid, giving a complex mixture of sulphur compounds. Failure to detect and estimate these compounds in past analyses was partly responsible for the failure to attain a "sulphur balance."

Trade Catalogue

TRAINING SALESMEN. A carefully selected range of films covering every aspect of selling is listed in a new booklet "Films for Training Salesmen," issued by the G.B. Film Library, 1 Aintree Road, Perivale, Middlesex. In it are given synopses, catalogue numbers, running times, charges and, where applicable, purchase prices. Films featuring the well-known exponents of selling techniques, Richard Borden and Alvin Busse, are included, with others produced in America by the Dartnell Corp. of Chicago. Other production companies include the McGraw-Hill Text-Film Department of New York and Encyclopaedia Britannica films. With many films, meeting guides are provided to assist in the best use of the films at conferences, etc. Details are also given of the mobile projector scheme, operating throughout the country to provide 16 mm. projection facilities and the services of a skilled operator for organisations not possessing projection equipment.

Paper Chromatography of Synthetic Dyestuffs

IN a recent address to the West Riding Section of the Society of Dyers and Colourists, Mr. J. C. Brown, B.Sc., A.R.I.C. (Ciba Clayton Ltd.) discussed the broad principles of the method and drew comparisons between paper and column chromatography for the following main divisions of the subject:—

(1) Adsorption chromatography.
(2) Partition chromatography.
(3) Ion-exchange chromatography.

Practical methods of manipulating the paper were described for ascending and descending techniques. The application of the method to dyestuffs was illustrated by examples of the use of chromatography with disperse, direct cotton, acid levelling and 2 : 1 metal complex dyestuffs. Chromatograms of all these types were illustrated by means of lantern slides and practical examples of extracts from dyed fibres were chosen in each case.

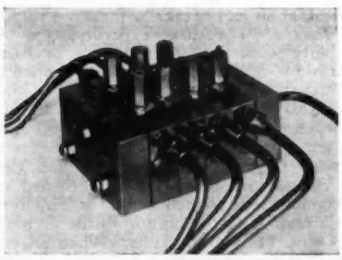
Among the methods developed by the lecturer was one of reverse phase partition chromatography for disperse colours and the use of diethyl amino ethyl cellulose ion exchange paper for 2 : 1 metal complex dyestuffs. Particular attention was paid to the chromatography of direct cotton dyestuffs, in view of the lack of previous work in this field, and dimethylformamide was found to be particularly effective in various mixtures as an effluent suitable for direct dyestuffs.

Mr. Brown concluded by stressing the importance of any new technique which was of value in dyestuff identification, especially in view of the large range of possible combinations now available to the dyer.

Reset Indicators Pinpoint Blockage in Automatic Lubrication System

A NEW trouble indicator for use with the company's centralised lubricating systems is announced by Exactor Ltd., Church Way, Edgware, Middlesex. This new indicator fits into the distributor unit which feeds automatically to each bearing in turn a measured "shot" of lubricant. The new Exactor-Trabon reset indicator, available for a range of operating pressures (from 250 up to 2,500 p.s.i.), pinpoints any blocked line condition which may occur in the centralised lubrication system. The indicator is screwed into the alternate outlet, or test plug tap of each outgoing line from the master and secondary distributors. If a feed line is blocked, the central visual or audible warning devices alert the operator. He then merely checks the indicators and the bearing line at which the trouble has arisen is shown by the indicator pin which under excessive pressure protrudes $\frac{1}{16}$in. out of the body of the reset indicator.

The Exactor-Trabon reset indicators return to normal position automatically when the fault has been corrected to permit pressure in the line to revert to the design level for the system. This new feature is stated to be dust, dirt and moisture-proof and not affected when installed in the worst possible conditions; the lubricant passes uncontaminated in measured shots direct from pump to bearing. The reset indicators can be supplied in bright compelling colours, so that the operator can quickly locate any defective line, or they can be used as contacts to give warning on a central control panel in the case of large installations.



The new Exactor-Trabon reset indicator pin-points any blockage stopping the flow of lubricant to the bearings and then automatically resets when the line is cleared

TEXTILE MACHINERY and MILL EQUIPMENT NEWS

Setting Yarns, Fabrics and Garments

Excellent results are stated to have been obtained with fabrics and garments made from modified filament nylon and with goods made from "Terylene" and triacetate

INCREASED interest of the hosiery industry in man-made fibres, particularly polymides, polyester, acrylics and triacetate, has coincided with an important contribution made to the industry by Andrew Engineering and Development Co. Ltd., who recently launched an improved version of their Auto-Setter for steam setting yarns, fabrics and garments.

The machine is of simple, robust construction, with a rectangular autoclave to allow full utilisation of its inner space for steaming It has a smooth running sliding door with adequate clamping screws to keep it leakproof against either pressure or vacuum. There are two sets of trays contained in holding frames to enable quick loading and unloading of the machine, with trolleys for conveying the frames to and from the loading and/or unloading station. This eliminates delays between steaming cycles.

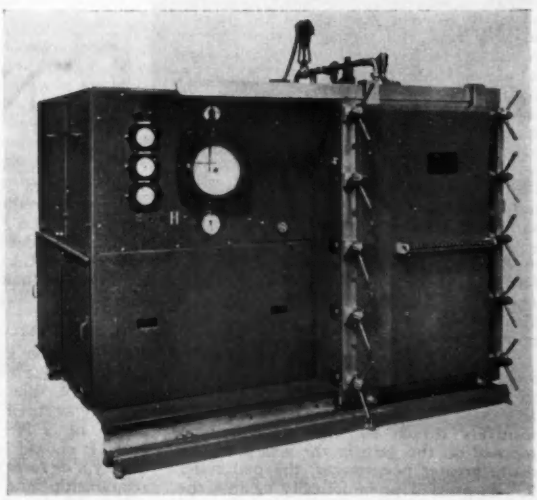
The machine requires little manual operation. Once the operational sequence has been decided and the settings made, the operator has only to press the starter button and all operations follow automatically in smooth succession to the end of the steaming sequence. A series of dials and signal lights mounted on the control panel enable the operative to deduce at a glance the exact stage of the steaming cycle at any time. By simply operating a selector switch on the control panel, the machine will operate a single or double steaming cycle.

When the machine is loaded and the door securely clamped, operation of the start button sets the vacuum pump in motion. The pump evacuates air from the interior of the steaming chamber up to 26 - 28 ins. Hg. in approximately 90 secs. The required degree of vacuum is selected on an adjustable vacuum/pressure switch, and when this set point is reached the pump is stopped and the steam inlet valve automatically opened. Immediately this valve is opened, a red warning light shows on the control panel, indicating to the operator that steam is being admitted to the chamber, and the door should not be opened whilst it continues to show.

During steaming, the motor of the steam inlet valve is controlled through a transistorise pdower pack by a sensitive resistance element, and once the required temperature has been reached this instrument causes the inlet valve to modulate, and will control and maintain the temperature in the chamber to within $\pm \frac{1}{2}$ C. of the setting. A dial calibrated in °C. is provided for setting the temperature, together with a small pilot to indicate when the set temperature has been reached. The length of the steaming period is controlled by a process timer with a range of 0 - 30 mins., and can be set for any length of time within that range.

In double steaming two process timers are used, and these may be set for dissimilar periods if required. Whether the machine is operating single or double steaming periods, the process timer(s) controlling the length of the cycle(s) do not commence to operate until the required temperature has been reached, thereby ensuring all goods are processed for the same length of time at the required temperature setting. When the first steaming cycle is completed, the steam inlet valve closes and, in so doing, operates the exhaust valve to open. To overcome variations in local conditions, the exhausting period can also be varied in length by a process timer, ensuring pressure in the autoclave is equal to that of the atmosphere before the machine proceeds to its next operation.

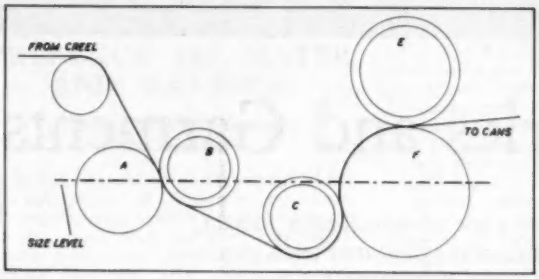
After the time allowed for exhausting has expired, the vacuum pump is re-started and will again extract air and any residual condensate from the chamber up to 26 - 28 ins. Hg. If the machine is set to operate a single steaming period, this vacuum will conclude its cycle of operations, but if set for double steaming, the steam inlet valve will again open when the required degree of vacuum has been reached. The machine will then operate another steaming period as described earlier, followed by an exhaust period and a third vacuum extraction. A green light on the control panel indicates the machine has completed its cycle of operations and the door can then be opened. The trays containing processed goods can be easily removed and freshly loaded goods placed in the steaming chamber.

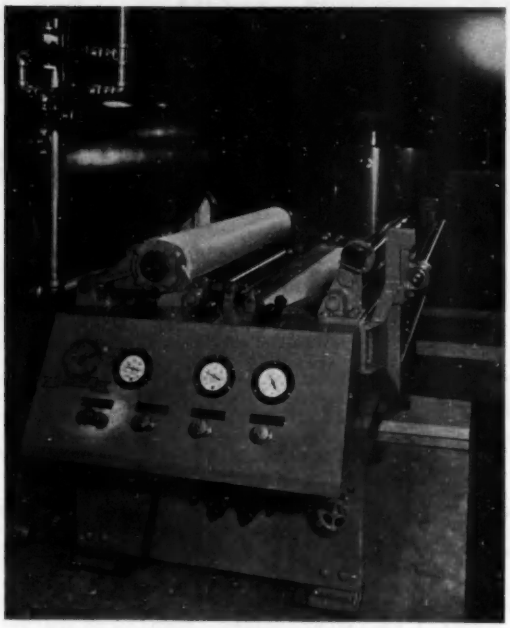


Once the operational sequence has been decided and the settings made, all the operator has to do is press a starter button and operations follow automatically

Two standard models for operating at either low or high pressure are now in production.

Excellent results are said to have been obtained with fabrics and garments made from modified continuous filament nylon (Ban-Lon, Agilon "D," Frostex "D," Saaba, Depaloft, etc.). Dyeing with acid type and premetallised dyes together with residual shrinkage measurements on the material after setting, give confirmation that the steaming is extremely uniform with complete absence of temperature gradients. Similar results are claimed with goods and fabrics made from "Terylene" and triacetate.





(above) Passage of warp yarn through the new size box (right)

Features in Latest Size Master Size Box

DESIGNED to give both greater size penetration of high density filament warps and to control degrees of stretch within the strict limits, the Sizemaster size box, introduced by Cocker Machine and Foundry Co., Gastonia, North Carolina, U.S.A., is planned for use not only with Cocker's own sizing machines but with all other makes.

A positively driven stainless steel feed roll "A," pulls the yarn from the beams in the creel and as the yarn is still dry, stretch is, according to the type of filament yarn in process, kept down to approximately 1 to 1½%. The yarn is carried round the feed roll and is nipped between it and a rubber-covered roll "B" under considerable pressure. The effect of this is to exclude from the yarn the air which is held between the filaments of the individual ends. The size level in the box is held at the point of release of the yarn from the nip of these two rollers, with the result that immediately pressure on the yarn is released, it is immersed in the size and has a sponge-like tendency to draw up the liquor into the yarn and between the filaments, achieving, therefore, a high degree of penetration into the yarn rather than merely coating it as under normal conditions.

The yarn then passes under the rubber-covered roller "C" and out between the nip of dressing rollers "E" and "F." The bottom roller "F" is, like feed roller "A" positively driven so that no stretch is imposed on the yarn in the size pan. To insure greater penetration, the pad roller "C" is pressed pneumatically against the bottom roller "F," but it can also be used as a conventional immersion roller. For ease of cleaning of the size pan, the rollers "B" and "C" can be raised pneumatically, giving free access not only to the pan itself but also to the delivery and dressing rollers "E" and "F."

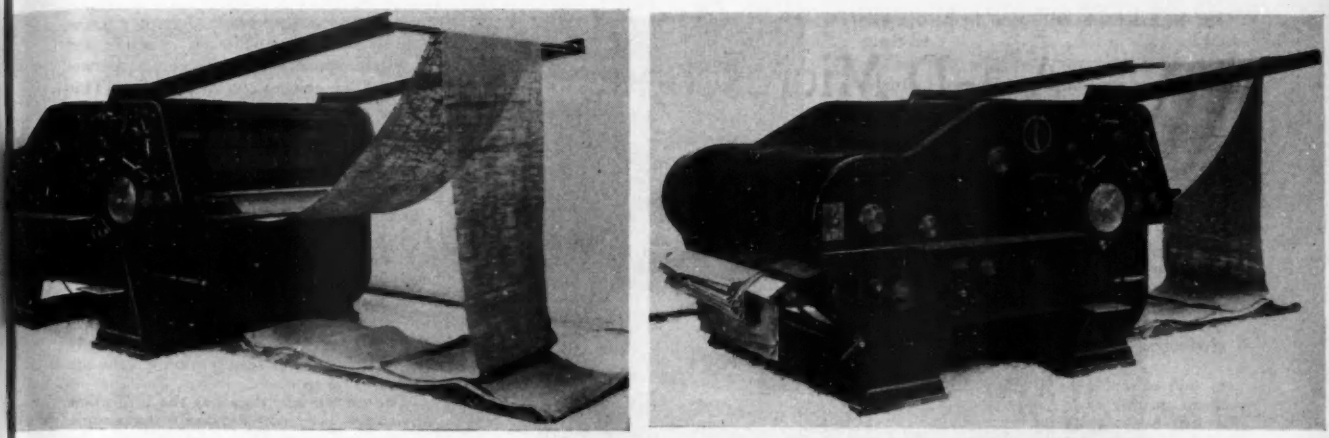
Under mill operation in America, the new Sizemaster box has proved to be completely successful and to provide a simple alternative to the more difficult system of splitting these close set warps into two and running them through two separate size boxes and delivering to individual drying cylinders. No difficulties have been experienced in subsequent finishing of the cloth, the size being readily removed by normal processing. Export agents for Cocker Machine Co. are Lendt and Co., 535 Fifth Avenue, New York 17, New York, U.S.A., and in the U.K. and Eire, are represented by Barke Machinery Ltd., 100 Portland Street, Ashton-under-Lyne, Lancs.

New Name for F.N.F.

F.N.F. Machinery Manufacturing Co. Ltd., makers of the famous F.N.F. compound needle high speed warp knitting machine, the Cascade warper, the Courtaulds' design tow-to-top converter, and the W.I.R.A. dropper pinning machine, commenced manufacturing at Burton-on-Trent in 1946 as a subsidiary of Courtaulds Ltd.

In 1958, Hobourn Aero Components Ltd. acquired an interest in F.N.F. and agreed to take over the management, and to signify this link it was decided as recently as April 11th, 1960, to change the name of F.N.F. to Hobourn - F.N.F. Ltd. It should be emphasised that this is simply a *de facto* recognition of an existing relationship and in no way affects the policy of the company: to continue to develop, manufacture and market the wide range of precision built textile machinery for which F.N.F. is world famous.

The Hobourn Group now manufacture a wide variety of high quality textile machinery including the E.P.I. false twist machine, the Agilon 2110 edge crimp unit, cone winders and braiders (Hobourn Aero components Ltd., Rochester, Kent); the Roberts Arrow spinning frame (Hobourn-Roberts Ltd., Burton-on-Trent, Staffs.); and the wide range of F.N.F. machinery (Hobourn-F.N.F. Ltd., Burton-on-Trent, Staffs.). The resources of this engineering group will be used to ensure the machines required by the textile trade are manufactured with precision and developed to meet the ever-changing commercial needs.



Front and rear views of the "Scimitar" cutting and folding machine

Cutting and Folding Bag, etc. Cloths

NOW being demonstrated to the bag trade at Densfield Works, Dundee, the prototype of the "Scimitar" made by Thomas C. Keay Ltd., Baltic Street, Dundee, will cut at speeds of up to 100 per min. If fed continuously with cuts of cloth piece-ended together, productions of up to 30,000 cut and folded pieces a day are possible. Designed to cut and fold jute cloth prior to the sewing, it is ideally suited for bag makers producing bags which are to be sewn up side and bottom, having selvedge at the mouth. It will also, of course, cut and fold bags which are to be sewn up two sides.

When cloth is passed through the "Scimitar," cut and folded pieces are laid-off on a "horse" ready to go straight to the sewing machine operator. In many bag factories where guillotine type cutting machines are used, the cloth is passed to the sewing machines in an unfolded condition, which means that the operator has to fold each piece of cloth herself prior to sewing. In other factories additional labour is employed to manually fold the pieces of cloth between the cutting and sewing operations. It is claimed that if a "Scimitar" is used the sewing machine operatives in the former case will get increased production, not having to do their own folding, and in the latter case the additional labour employed on manual folding is saved.

The two photographs are views from either end of the prototype machine, which will handle cloth up to 60-in. wide. One shows cloth entering the machine at the feed end, and the other view, taken from the delivery end, shows folded pieces of cloth which have been laid-off on the delivery "horse."

Preventing Dust and Grit Emission from Boilers

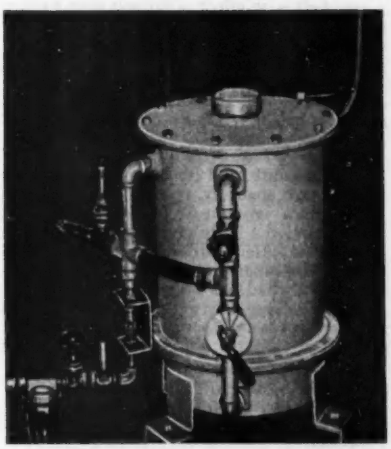
SMUT emission from boilers is caused primarily by the high SO_3 content of the gases and the consequent high dew-point temperature, resulting in local condensation on cold sections of flues and particularly stacks, together with the deposition of very fine greasy particles in these sections. These particles, which build up into loose agglomentes, adhere only lightly to the surfaces and the slightest variation in gas velocity will entrain them in the gas stream in the form of smuts or sooty flakes, the majority of which settle within 50 yards or so of the stack, resulting in considerable damage, principally because of their high acid content.

Considerable research into this problem has been undertaken by Dust Control Processes Ltd., 161 Clarence Street, Kingston-upon-Thames, and after exhaustive full scale tests the company announce a new machine designed to provide an efficient and effective solution.

Known as the Insufflator the new machine injects into the flue gases, a controlled concentration of a finely divided alkaline hygroscopic precipitate (D.C.P. 58 Sulpho Neutraliser), which provide nuclei for the absorption of acid and the fine greasy particles. To ensure intimate mixing, the powder and gases are subjected to a high degree of turbulence in the D.C.P. Turbulator, a device which achieves its object by employing a high carrier air exit velocity to cause dispersion of the particles over a wide area and giving even distribution.

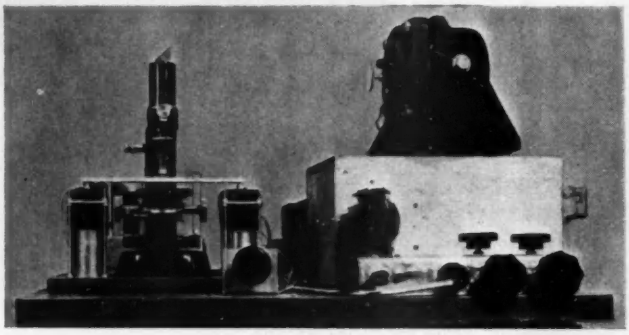
The agglomerated particles are then centrifuged from the gas stream by the Turbocell dust collector. This is a particularly compact model arranged to permit maximum flexibility of interconnecting ductwork and consisting of a battery of cyclonic cells, designed to operate at a low power cast level, and to achieve a high level extraction of fine particles.

An extremely important advantage claimed for this system is the neutralising of the acidity, inherent in the gas and particle mixture, which results in corrosion inhibition and a considerable reduction in the dewpoint temperature of the gases.



View of the D.C.P. Insufflator

A 3-D Microscope



A MICROSCOPE which gives a three-dimensional image or luminous model of the object was on show for the first time on the D.S.I.R. stand at the Instruments, Electronics and Automation Exhibition at Olympia. Designed by a team led by Mr. R. Gregory at the Cambridge University Psychological Laboratory and supported by a D.S.I.R. grant, it is intended particularly for use in biological research. It should prove useful for examining living cells and, unlike the conventional stereoscopic microscope which gives an appearance of depth by providing a slightly different picture to each eye, this new instrument gives a truly solid image projected into a cube of space.

When a thick specimen is under observation by a normal microscope, only a thin section of it can be in sharp focus for any one setting of the focusing screw and it is only possible to examine the complete specimen by focusing successively through the specimen. This limitation is actually put to use in the operation of the solid image microscope. The solid image is built up by vibrating the focusing mechanism up and down so that the thin plane of focus scans the object in depth. The constantly changing image given by the scan is then projected on to a screen which vibrates in precise synchrony with the object scan but with greater amplitude. The magnified image is formed in the cube of space swept by the vibrating screen. It is quite steady because the rate of scan is too high for the flicker to be seen.

The instrument thus has the important advantage over conventional stereoscopic microscopes that thick sections can be observed in depth. One disadvantage is that the solid image suffers from lack of contrast due to the ambient light in the cube space in which the image lies, and this can be serious. It is possible to dispense with vibrating parts in favour of just two rotating optical elements mounted on a single shaft. This may prove a simple and effective way of providing solid images once the technical difficulties of making the special optical surfaces are overcome.

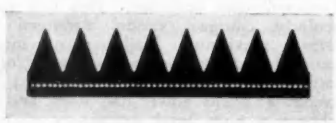
New Approach to Power Transmission

CLAIMED to incorporate the best features of V-belt and flat belt drives and to make possible an increase in drive capacity of up to 50%, the "Poly-V" drive recently introduced by Turner Brothers Asbestos Ltd., Rochdale, has already aroused considerable interest in textile and engineering, etc., circles. The new belt is, in effect, a flat belt with a series of parallel V-shaped ribs moulded on its inner surface. These ribs form the driving surface of the belt and completely fill mating grooves on the pulleys, there being no clearance between the two.

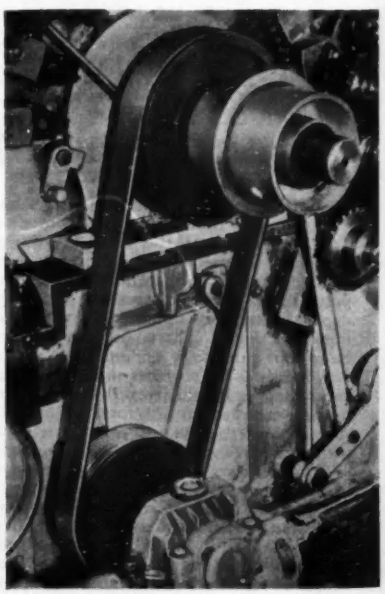
The belt is made from synthetic rubber compounds and the strength member is made from high tenacity synthetic cords of great strength, and resilience to shock. The cords are specially treated to secure the maximum amount of adhesion between them and the body of the belt. The base rubber is softer than normally employed in "V" belt constructions. This allows it to act somewhat like a hydraulic fluid, completely filling the pulley grooves during belt embrace and exerting an even pressure, all over the rib face, thereby securing uniform belt and pulley wear. The rib faces are covered with cover cloths or, in the case of the smallest belts with special compounds containing a high proportion of fibre.

The makers emphasise that the method of construction gives two important benefits. First, the load-carrying member extends across the full face of the drive, unlike the multiple V-belt drive where part of the total drive width available is wasted by the space between belts. Secondly, the grooved inner face of the belt has about twice the surface area in contact with the pulleys when compared with a multiple belt drive of similar widths.

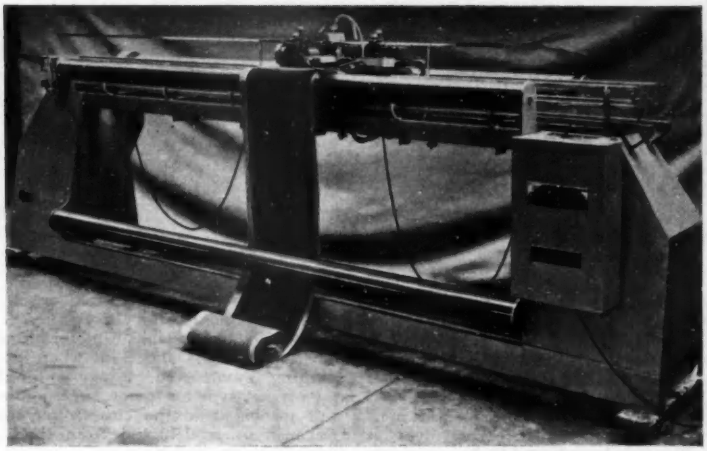
The "Poly-V" belt is made in three sizes known as J. L and M. sections. They have rib widths of $\frac{1}{32}$, $\frac{1}{16}$ and $\frac{3}{32}$ in. respectively and the V angle is 40° in each case. The drive has an uninterrupted strength member across the width of the pulley and all parts of the belt thus work together, the load being evenly distributed over the full width of the pulley giving, it is stated, higher horse-power capacity per inch of drive width and greater flexibility. "Poly-V" belts are claimed to maintain a constant pitch diameter at all loads, full contact gives solid support under the strength member and speed ratios are therefore unchanged when moving from "no load" to "full load." The makers anticipate many applications in the textile industry, including the main drives to flat or roller and clearer cards, and looms where strict maintenance of the correct speed ratios is particularly important. It is also expected to replace many existing drives on a wide range of machinery in other industries.



The "M" type ($\frac{3}{32}$ in. ribs). "Poly-V" belt cross-section in the above illustration, together with the "L" type ($\frac{1}{16}$ in. ribs) cover five standard "V" belt sections



This smooth-running "Poly-V" drive replaced chain on this flat card. It is said to have eliminated breakages previously arising from shock loads



The new B.T.M. carpet slitting and trimming machine

Carpet Slitting and Trimming Machine

THE automatic carpet slitting and/or trimming machine developed by British Tufting Machinery Ltd., Blackburn, is a further step towards automation in the tufted carpet industry. This new machine receives carpet from the coater and stores it with the selvedges untrimmed. When required for trimming, the carpet is mounted on an unroll stand at the front of the machine. It is then taken up into the slitting and trimming machine with the pile facing upwards.

The machine is equipped with a sensing and tracking head and a finger on the sensing head runs along the outside row of tufts. This finger is connected to micro-switches and lateral movement of the carpet moves the finger which in turn causes the tracking head to move. The tracking head consists of an electric motor and reduction gear which drives two pinion wheels that are constantly in mesh with two chains mounted on the head of the machine.

The two selvedge trimming units are mounted on wheels that move on rails running across the machine. These trimming units are connected by thumb-screws to a bar graduated in feet and inches. This bar is also coupled to the tracking head. As a result the trimmers and tracking head move together in unison and trim the carpet to a pre-set spacing. Two fractional horsepower motors drive each trimming unit through reduction gears. The actual cutting is done by twin disc-shaped cutters and as they run at slow speeds these have a long life between re-sharpening. The discs are particularly easy to change.

If the carpet is to be slit into two or more narrow widths, more slitting heads can be mounted on the rails and run in conjunction with the trimmers. Behind the machine a rolling-up machine can be fitted. This will take the trimmed and/or slit rolls. Trimmed selvedges are allowed to drop into containers mounted below the trimming unit and these can be removed easily whenever they are filled. Normally the trimming and slitting machine runs at 12 - 14 ft./min., but by means of a variable speed drive to the rubber-covered drive rollers this speed can be adjusted to suit the carpet being handled.

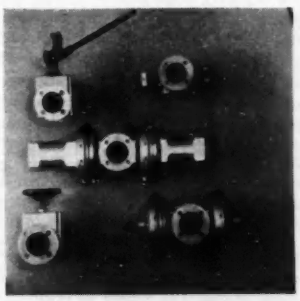
The B.T.M. trimmer cuts carpeting very accurately, particularly tufted carpet made on machines equipped with tracking type backing cloth stands. This enables a further economy to be made as the amount of overtufting, beyond the desired final width required, can be substantially reduced. The machine is particularly useful for trimming tufted carpets having either scrim or foam rubber backings on which the tuft line is not visible.

New Methods of Operation for Pinch Valves

NEW operational systems for their pinch valves are announced by W. H. Rowe and Son Ltd., Quayside Road, Bitterne Manor, Southampton. The range has now been extended to include valves operated by lever, air cylinder and diaphragm motor.

The lever-operated pinch valve can be made to 'fail safe' in the event of a breakdown in the actuating system simply by fitting a weight, and it can be used as a positionally controlled valve by employing an air cylinder with a positional controller as an actuator. Mechanical linkage, flexible cables and air or hydraulic cylinders are all suitable methods for operating this valve.

Air cylinders and diaphragm motors take pinch valve operation a stage further, to the stage where mechanical linkage systems are dispensed with entirely. Two types of diaphragm-operated valve are available depending on whether the horizontally opposed anvils are required to close to pinch or open against spring pressure. The advantage of the 'air-to-open' drive is that the valve 'fails safe' in the event of a breakdown in the air or power supply.



Range of Rowe pinch valves: (top left) lever-operated, (top right) air cylinder operated, (centre) "air to open" diaphragm operated, (bottom left) hand-operated, (bottom right) "air to close" diaphragm-operated

Diaphragm-operated pinch valves are fitted with two motors, one to each anvil. The push rods which drive the pinch anvils are extended so as to pass through the outer diaphragm chambers. In this way they serve to indicate valve opening as well as providing references for positional controllers. Although two motors are employed, only one positional controller is required. With the exception of the air cylinder-operated model, all valves are available with bore diameters of 1 in., 2 ins. and 3 ins. The hand-operated valve is also available with 1½-in. and 4-in. bores. The air-cylinder operated valve is made only in the 2-in. bore but connection to 1-in. or 3-in. lines can be made by means of tapered adaptors.

Technical Information

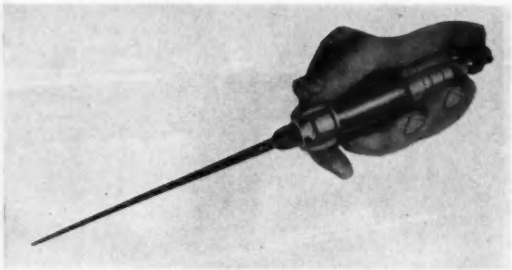
The following publications are now available from I.C.I. Ltd., Dyestuffs Division, Blackley, Manchester:—

No. 547. Effect of the Si-Ro-Set Method of Durable Pleating on Dyes Applied to "Acrilan," Silk, Nylon, "Terylene," Secondary Acetate Rayon and Triacetate Rayon.

No. PC/C.19. Vantropol BQ: A Bacterial Detergent for Use in Hospitals.

No. 121. Dispersol AFB: An Agent for Promoting Level Dyeing of Basic Dyes on Acrylic Fibres.

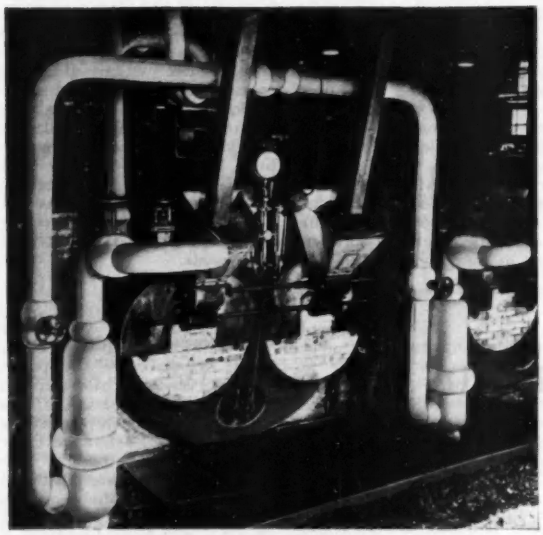
American Ring and Speed Frame Roller Picker



THE problem of loose lint and fly gathering in the necks and ends of ring and speed frame rollers has often proved costly to spinners due to stoppages for cleaning and, at the same time troublesome and dangerous to the operative. The Society for the Prevention of Accidents lists many instances where an operative, usually wearing a ring, has suffered injury whilst "piking" a roller clean when the machine is running.

An automatic roller picker manufactured by Gardner-Denver Co., Illinois, U.S.A., is now available in the U.K. It obviates the foregoing problems and reduces frame stoppages considerably. Quiet in operation and light in weight, the Keller 12 P-1 picker consists of a picker rod mounted on ball bearings for smooth non-whip operation. This rod revolves at variable speeds, adjustable by a simple built-in air regulator. The adjustment is necessary because excessive speed causes the lint to be thrown off before the roller is clean; insufficient revolutions results in failure to gather the lint successfully. Two sizes of rod are available, 6-in. for ordinary open type rollers and 9-in. where apron drafting is employed. Power is supplied by a rotary type air motor, precision built and machined to the closest tolerances. Exhaust air is deflected from the rear, away from the frame.

Agents in the U.K. are Gaston E. Marbaix Ltd., Devonshire House, Vicarage Crescent, London, S.W.11.



Lancashire boiler/steam accumulator, dual capacity. British Boiler Accessories Ltd.

Increasing Boiler Efficiency

A METHOD of increasing the efficiency of boilers in applications where there is a fluctuating demand for steam has been developed by British Boiler Accessories Ltd., 62-3 Fenchurch Street, London, E.C.3. This involves the use of a Lancashire boiler which can be a steam accumulator or standby boiler and which by storing surplus steam produced during periods of small demand and releasing it during peak load periods enables the boilers to operate steadily at an even rate corresponding to the average steam consumption throughout the day.

In the B.B.A. steam accumulator the steam is stored in the form of hot water and the system works on the variable pressure principle. This depends on the fact that the boiling point of water varies according to the pressure on its surface; thus the boiling point which is 212°F., at sea level increases to 388°F., at a pressure of 200 lbs. p.s.i.

The water is contained in a closed vessel which is partly filled and its temperature is raised to 212°F., by mixing it with live steam. When this temperature is reached, a small amount of steam is formed which, as it is unable to escape, increases the atmospheric pressure within the vessel. The temperature is then further increased by mixing the water with more steam and when this reaches the boiling point corresponding to the increased pressure, another small amount of steam is produced which again increases the pressure, the process being continually repeated.

When a valve at the top of the vessel is opened to release the steam for use, the pressure within the vessel is reduced and as the water has a high temperature in relation to the new pressure, it commences to boil, a certain amount of it being converted into steam. This takes out a quantity of the latent heat from the remaining water, the temperature of which consequently drops until the balance between pressure and temperature is restored.

B.B.A. have developed the external charging device for fitting to standby Lancashire boilers. The provision of this device does not necessitate the normal B.B.A. internal charging devices, for which the Company is well known or alterations to the boiler and therefore does not impair its capacity to operate as a primary steam generator when this is required. The charging device works similar to an injector. Live steam from the high pressure main is injected through a nozzle creating a strong suction effect which draws water from the standby boiler and injects it into a venturi tube where the steam and water are thoroughly mixed, the steam being condensed. The heated water flows to the upper part of the standby boiler and sets up a strong circulation of its water content whereby cool water is drawn from the lower part of the standby boiler, heated in the charging device and returned to the upper part. The accumulator/standby boiler is thus charged by gradually raising the temperature and pressure of its contents.

Discharge is controlled by a reducing valve and charging can be controlled either manually or by a valve worked by the high pressure main in which case the accumulator works automatically. In cases where Lancashire boilers have been converted into steam accumulators by the fitting of the B.B.A. charging device the cost of fitting has been recovered in as little as twelve months operation.

THE TEXTILE
COLOURIST & FINISHER

The Applications of Dichlorophen in the Textile Industry

In this outline of the applications the authors discuss methods of estimation, microbiological and insect repellant activities, rot-proofing properties, soil burial and weathering tests, etc. Included in more than 40 military specifications, the methods of application include aqueous, emulsion and solvent techniques

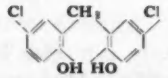
By R. J. COLLINS and B. E. PURKISS*

SINCE 2,2'-dihydroxy-5,5'-dichlorodiphenylmethane (known more familiarly as "Panacide" in Britain and "G.4." in America) has been proposed for inclusion in the forthcoming revision of B.S. 2087, this seems a suitable occasion for examining its potentialities in the textile industry. For the purpose of this paper this compound is referred to as dichlorophen—the name in common usage.

Although dichlorophen has been known for some years it is only during the last decade that its value has been fully appreciated. Prior to 1949 it was used mainly by the armed forces (although it was patented by I.G. Farben. as a moth killer). Since its removal from the secret list its use has been extended to many industries until, in 1957, Rose *et al.*[1] described it as the largest selling colourless organic microbicide in the world's textile industries. Because of dichlorophen's low mammalian toxicity its properties were soon used by the British drug industry for medical purposes and, as production costs were reduced it has become possible to meet the economic requirements of the paper and textile industries. When dichlorophen was gaining acceptance in the pharmaceutical field the British Ministry of Supply was making its own first evaluations of the material as a rot-proofing agent. This field work culminated in the Ministry's consideration of dichlorophen for inclusion in B.S. 2087.

* *Technical Development Department, British Drug Houses Ltd., Graham Street, London, N.*1.

Chemical Properties

Structural formula	
Empirical formula	$C_{13}H_{10}O_2Cl_2$
Molecular weight	269·14

As would be expected, dichlorophen behaves generally as a dihydric phenol and is easily acetylated and benzoylated. Use of its phenolic properties is made in several methods for the assay of dichlorophen.

It forms a series of metallic derivatives with most of the common metals and these metal salts are usually more water-soluble than the free phenol. A large proportion of the dichlorophen in industry is, in fact, used as the mono-sodium salt in aqueous solution.

There are references to the use of dichlorophen as an antioxidant for fats and waxes, where it appears to suppress the formation of peroxides. Morawetz,[2] Bickoff,[3] and Larsen[4] have all reported on this property.

The free phenol is not aggressive to metals in laboratory tests and several years' experience in industrial usage have not produced any corrosion difficulties. The sodium and potassium salts are alkaline in solution and, at the higher concentrations, could attack aluminium.

The two phenolic groups endow dichlorophen with good substantivity to protein fibres, such as wool; its retention upon cellulose is also good.

Estimation of Dichlorophen

There are a number of methods for the estimation of dichlorophen. Some depend upon the reactions of the hydroxyl groups, others upon the chloro groups and the remainder upon the spectrophotometry of dichlorophen or of dyes derived from it. Benk[5] gives a number of qualitative tests which can be used in detecting the presence of dichlorophen in cloth (Table 1).

Table 1. Qualitative Tests for Dichlorophen

Test	Result
Beilstein test	**Pronounced reaction for chlorine**
Ignition	**Evolves HCl**
HNO_3/Heat/$AgNO_3$	**Precipitates AgCl**
$KMnO_4$/Alkali	**Reduced in the cold giving a green solution and a precipitate of MnO_2**
Phosphomolybdic acid solution	**Blue colour**
Ammoniacal silver nitrate	**Reduced on warming**
Ferric chloride solution	**Green - violet - blue colour**
Millon's reagent	**Red solution after filtering**

The simplest method for the quantitative analysis of dichlorophen is probably that of the British Veterinary Codex, 1953.[6] This is based on the decomposition of dichlorophen with alkaline permanganate solution and the determination of the chlorine so liberated by the Volhard method. The new British Standard method (B.S. 2087), now under revision, uses a similar method based upon an acetic acid/ethanol soxhlet extract of the fabric.

Singer and Stern[7] describe a spectrophotometric method depending upon the reaction with 2,6-dibromoquinone chloroimide buffered at pH 9-10. Shiraeff[8] used the yellow colour which developed with sodium hypochlorite. Other methods have been described by Gottlieb and Marsh[9] (colorimetric determination of a red dye formed with 4-aminoantipyrine); Bolle and Mirimanoff[10] (reaction with ammoniacal diazotized sulphanilic acid); Willard and Thompson,[11] Clements and Newburger,[12] Reissman,[13] and Marshall and Feinsilver.[14]

Physical Properties

	Melting points:	
Pure	178°C.	Colourless
Impregnation grade	min. 170°C.	Almost white powder
Technical	about 164°C.	Off-white powder

Solubility:

Dichlorophen is sparingly soluble in water, but readily soluble in organic polar solvents, less so in non-polar solvents and soluble in some oils.

Table 2. Solubility of Dichlorophen at 25°C.

Water	0·003 g./100 ml.
Industrial alcohol	100 g./100 ml.
Ethanol	53 g./100 ml.
Acetone	80 g./100 ml.
Propylene glycol	45 g./100 ml.
White spirit ..	0·2 g./100 ml.*

*** Solutions of 10% or more can be prepared by adding small amounts of acetone or iso-propyl alcohol to the white spirit.**

The sodium, ammonium, and potassium salts are freely soluble in water—the 40% sodium salt solution being the commonest commercial form.

Dichlorophen has low steam volatility and low vapour pressure. It can be used economically in impregnation processes where the fabric is subjected to high temperature drying, since it is not lost by volatilisation in the steam. This low volatility gives it a further advantage over other chlorinated phenols because of its persistence when exposed to tropical humidity (Table 3).

Table 3.

Vapour Pressure

10^{-4} mm. of mercury at 100°C.
10^{-10} mm. of mercury at 25°C.

pk Values

For the two hydroxyl groups at 25°C.

1st	7·6
2nd	11·5

Biological Aspects

An important feature of dichlorophen is its very low mammalian toxicity. In the purer forms it is used for the treatment of tapeworm infections in humans and animals. At the concentration employed in the textile industry, dichlorophen is considered to be non-irritating to the skin; the U.S. Government has approved the use of dichlorophen in fabrics in intimate contact with the skin (Waksman *et al.*[15]).

Numerous workers in U.S.A. and U.K. have investigated the systemic toxicity of dichlorophen and some of their findings are given in Table 4.

Microbiological Activity

Dichlorophen has become noted for the extremely wide range of micro-organisms which it will kill: this ability to kill bacteria and fungi as well as algae, greatly extends its applications. The literature contains many reports upon the microbicidal activity of dichlorophen and the following Table 5 serves to illustrate the toxic effects upon various micro-organisms.

It will be seen from Table 5 that the range of micro-organisms which are killed by dichlorophen is wide. This feature has been responsible for the increase in its application in the textile industry, since the successful protectant should act against as many species of micro-organisms as possible.

The data quoted are all the results of *in vitro* work, usually upon plate culture. Whilst this sort of test bears very little relation to the conditions of bacterial attack in the field, it does offer a useful method of establishing the overall range of the microbicide and various basic weaknesses of the compounds may be demonstrated. The micro-organisms which cause degradation of textile fabrics in use are all derived from the normal microbial population of the soil.

Table 4.

Animal	LD_{50}	Worker
Mice	1·00 g./kg.	Florestano[16]
Guinea-pigs	1·25 g./kg.	Unpublished results
Dogs	2·00 g./kg.	Craige, Kleckner[17]
Sheep	1·67 g./kg.	Ryff, Honess[18]

Note: LD_{50} = dose per kilogramme of body weight at which 50% of the experimental animals died.

Fish Toxicity

The Ministry of Agriculture, Fisheries and Food, Freshwater Biology Unit, found dichlorophen to be the least toxic of a group of industrial fungicides. The diagram at Fig. 1 shows the relative toxicity of some fungicides compared with dichlorophen = 1. It should be noted that the data upon which the diagram is based refer to the unadulterated fungicide in each case and not to formulated dilutions.

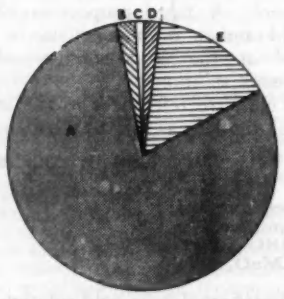


Fig. 1. Phenyl mercury acetate = 135·0. B. Copper quinolinolate = 3·9. C. Panacide = 1·0. D. Sodium pentachlorophonate = 3·2. E. Tributyl tin oxide = 25·7

Several attempts have been made to discover why dichlorophen is toxic to bacteria and fungi and it is clear that its action is not due to one single property. Dichlorophen does not appear to depend on the reduction of surface tension or on the modification of permeability of the cell wall: it is not purely the result of a chemical reaction with the cell contents—such as the dehydration of the cytoplasm or denaturing of protein constituents.

There are at least four different modes of attack possible with dichlorophen which may all act at the same time.

(1) Dichlorophen is phenolic by nature and part of its activity is due to the presence of two hydroxyl groups in its structure. This has been shown by the work of Marsh, Greathouse *et al.*[19] and Coe, Smith *et al.* in the laboratories of British Drug Houses Ltd. Blocking of the hydroxyl groups by means of

Table 5. Toxic Concentrations of Dichlorophen

Organism	Concentration	Reported by
Staph. aureus (Oxford) ..	0·25 p.p.m.	J. Coe and A. Smith[29]
B. subtilis	2·00 „	J. Coe
S. typhi	12·00 „	J. Coe
E. coli	12·00 „	J. Coe
Var. M. pyogenes var aureus	0·20 „	Erlandson and Lawrence[30]
Aspergillus niger	60·00 „	Watkins and Klemme[31]
Penicillium spp.	12·00 „	
Chaetomium globosum ..	20·00 „	J. Coe and A. Smith[29]
Oidium lactis	25·00 „	Beckett (private communication)
Scenedesmus	10·00 „	A. Smith[29]
Oscillatoria	10·00 „	A. Smith[29]
D. desulphuricans	5·00 „	Postgate (private communication)
Thiobacillus thio-oxidans ..	10·00 „	J. Coe[29]
Myrothecium verrucaria ..	10·00 „	J. Coe

N.B.—It should be remembered that the results submitted by the various workers above cannot be taken as strictly comparable due to variations in techniques.

acetylation, benzoylation or the formation of certain metallic salts leads to pronounced reduction in the microbiological activity.

(2) The chlorine atoms in dichlorophen are firmly held and cannot be regarded as available chlorine. (There is, however, a release of some chlorine under conditions of actinic irradiation). The powerful reaction of dichlorophen is not, therefore, accounted for solely by its chlorine content. Nevertheless, since Marsh and Butler[20] were able to show that the replacement of chlorine by bromine led to marked reduction in the bacterial and fungal toxicity, part of the activity of dichlorophen must be due to the chlorine atoms.

(3) Dichlorophen is an anionic compound and when combined with certain other anionic materials such as sodium lauryl sulphate will show a degree of synergism: on the other hand, certain other surfactants tend to inhibit its activity.
The surface action of dichlorophen does make some contribution to its effectiveness, since a suppression of the surface-active effect leads to diminution of the antibacterial and antifungal properties.

(4) Marsh and Butler (ibid.) have shown that the chemical configuration of dichlorophen makes the most important contribution to its action and that the bisphenol/methylene bridge structure is a potent factor in its performance.
This structural aspect may well be responsible for the well-known counter-enzyme action of dichlorophen, although the precise mechanism of the reaction is as yet obscure.
Dichlorophen has a profound effect upon the oxidase-reductase systems of cells and since this enzyme system is of such importance it could explain the versatility of dichlorophen.
This characteristic may be of prime importance in the suppression of the sulphate-reducing activity of *Desulphovibrio desulphuricans* in gasholder water (B.D.H. patent application).
This organism is known to be extremely sensitive to variations in the redox potential of its environment. (Postgate.[21])

Insect Repellent Activity

It is not surprising that dichlorophen should have been examined for its insecticidal action, when one considers its relationship to D.D.T.: it was in fact the subject of an I.G. Farben patent in 1929 as a moth repellent.[22] Luttringhaus[23, 24] described its use as a repellent for carpet beetle. Questel, in work performed for the U.S. Department of Agriculture,[25] reported a 100% kill when used against the European corn borer. The advent of other more potent insecticides, however, has reduced interest in this aspect of dichlorophen in recent years.

Table 6. Dichlorophen—Protection Afforded by Low Concentrations

% Dichlorophen in fabric	Residual strength after 12 days %
0·01	6
0·02	7
0·04	8
0·06	68
0·08	72

Dichlorophen as a Rotproofing Agent

Borghetty[26] expressed the opinion that dichlorophen possesses all the virtues of a rotproofing agent for cellulose materials: he lists these features as follows:—

(1) Endures outdoor exposure under jungle conditions.
(2) It is non-toxic.
(3) Applicable to streamline production methods.
(4) Readily available.
(5) Odourless.
(6) Colourless.
(7) Can be used with water repellent finishes.
(8) Effective at low concentrations.
(9) Non-volatile.
(10) Does not affect dyes or fibres adversely.

Goodavage[27] concurs with Borghetty and adds the advantages of water solubility and reports its affinity for cellulose. Other workers, such as Shanor,[28] report similarly. Marsh, Greathouse *et al.*[19] have reported the results of a laboratory evaluation of dichlorophen: they used low concentrations on a non-sterile 8-oz. cotton duck which was inoculated with a suspension of *Chaetomium globosum* and incubated for 12 days. Table 6 gives the residual percentage strengths of the fabric after incubation and serves to illustrate the lower limits of effectiveness of dichlorophen.

The same workers also report the results of combined leaching and inoculation experiments: in the first Table (Table 7) the data given were obtained after water leaching the impregnated 8-oz. cotton duck for 24 hours at a rate of 10 litres/hour and at a temperature of 30°C.

The next Table (Table 8) shows the effect of three static water leachings, each of 24 hours' duration: the amount of water used in each leach was equivalent to 250 times the weight of the sample of fabric under test. When leached, the sample was inoculated with a suspension of

Table 7.

Test organism	Fabric protectant	% compound before leaching					
		0·2	0·4	0·5	0·8	1·0	
Chaetomium globosum	Pentachlorphenol	0	0	0	0	0	% residual strength
	Salicylanilide	0	0	60	99	98	„ „
	Dichlorophen	7	89	88	99	90	„ „
Metarrhizium spp.	Pentachlorphenol	0	0	0	2	9	„ „
	Salicylanilide	0	2	0	98	98	„ „
	Dichlorophen	52	99	101	101	95	„ „

Chaetomium globosum and incubated for 12 days at 30°C.

Table 8.

Test organism	Fabric protectant	% compound before leaching					
		0·2	0·3	0·4	0·6	0·8	
Chaetomium globosum	Pentachlorphenol	0	0	0	1	98	% residual strength
	Salicylanilide	0	1	43	108	107	,, ,,
	Dichlorophen	7	33	37	110	111	,, ,,

Barker and Marsh[32] have reported the activity of dichlorophen upon a fabric which was steam sterilised before impregnation. The samples were inoculated with a range of micro-organisms and at 0.25% dichlorophen content, the fabric was found to be resistant to all the organisms tried. The incubation period was 14 days and *Chaetomium globosum*, *Penicillium* 66 and *Trichoderma* 29 were amongst the fungi used in the tests. Siu[33] lists *Chaetomium globosum* amongst the most destructive of the cellulolytic fungi.

The performance data quoted so far in this paper have all been obtained from artificial experiments conducted in the laboratory: a survey of this kind of literature would disclose many apparent discrepancies and disagreements. It must be borne in mind, however, that the whole field of microbiological evaluation has numerous difficulties which require the exercise of much caution. In natural conditions the process of microbial decay takes place as a result of such a variety of influences that it is inadvisable to attempt to deduce the probable effect of the factors by the manipulation of one of them in isolation. A sequence of carefully designed experiments is needed before even the least of reliable statements can be essayed.

The evaluation of fungicides or other antiseptics under controlled laboratory conditions has the advantage of reducing the number of co-adjuvant factors to a reasonable minimum, but, even then, certain phases are beyond the operator's control and not the least of these are the micro-organisms themselves.

The fact that two workers use *Staphylococcus aureus* as a test organism and, in doing so, obtain widely differing results is not an indication that there has been careless work, but is possibly due to their having used different strains of the same bacterium. The rate of reproduction of these relatively simple cells is so great by human standards (sometimes, in ideal conditions, there is one generation every 20 mins.) that their rate of evolution is correspondingly increased. The appearance of adapted or mutant strains is quite common and will frequently lead to the appearance of a pure culture which has resistances and susceptibilities differing most markedly from other cultures which are nominally the same. For example, there is at least one strain of *Staph. aureus* which is resistant to the action of penicillin though, in general, the other strains are quite easily killed.

It is safe to assume that comparative work done in a series of experiments conducted in the same laboratory at the same time by the same team of experienced workers is completely acceptable upon a scientific basis, but it would be most unwise to attempt a direct comparison of the work of two different laboratories. Testing in natural conditions seems to offer an answer to all the difficulties mentioned above, but due consideration will show that this is not so. Soil burial tests have the advantage that they are representative of the sort of environment which a fabric might experience, but there are weaknesses here too which are, fortunately, cancelled out to some extent by properly designed *in vitro* tests: consideration of the data obtained from both methods can lead one to a reasonably accurate and reproducible answer.

Soil Burial

The method of soil burial is recognised as being the most stringent means of evaluating a rotproofed fabric: the test material is buried in soil, along with an untreated control, and after the passage of time the residual tensile strengths of the fabrics are compared. A soil burial test forms an essential complement to the laboratory evaluation and finds its place in any reliable assessment of an antiseptic. Before considering the behaviour of dichlorophen in soil burial tests, it might not be out of place to consider the inherent weaknesses of the method: the accumulated data may then be seen in true perspective.

Soil is an extremely complex mixture of organic, inorganic and viable constituents: its variety is apparently infinite and its constitution haphazard to a degree. The inorganic portion is derived from clays and finely powdered weathered rock: the mineral fraction may represent 95% of the total weight of the soil, with the clays playing a major part in contributing to the texture and friability of the soil. The organic but non-viable fraction (Humus) is the result of biological decomposition of vegetable and animal matter by the micro-organisms of the soil. The composition is extremely variable, not merely from district to district, but even among small patches in the same field. The microbiological population of soils will, of course, vary to very much the same extent. As the clay present in soil forms a colloid it becomes the major site of most of the important chemical reactions in the soil: it has high moisture-retaining powers and is, to a large extent, responsible for the pH value of the soil and thus its bacterial concentration.

The fertility of a soil is governed by its content of the appropriate fungi bacteria and so on which are necessary to ensure the supply of simple chemical compounds which result from the decay of animal and vegetable residues. It will be seen that the more fertile a soil is the more vigorous its attack upon fabrics is likely to be. The pH value of soils will have a direct influence upon the bacterial content and will depend, in part, upon the presence or absence of clays and such materials as lime or humic acids. Soil bacteria are most abundant when the pH is on the alkaline side of neutrality, i.e. 7·0 - 7·5: they can, however, accommodate themselves to a quite remarkable extent. A soil at pH 7·5 may contain as many as 300,000,000 bacteria per gramme: at pH 8·0, 150,000,000 per gramme: and at pH 3·8 only 6,000,000 per gramme. Equally, the pH value of the soil will enhance or modify the performance of the rotproofing compound itself, either by direct chemical means or by biophysical influences. The moisture content and the temperature are two further important variables which may have an important influence upon the results of the soil burial tests. The presence of moisture is essential for microbiological activity; the absence of water will usually cause the micro-organisms to revert to the cyst or spore states. The metabolic process is, within certain narrow limits, accelerated or retarded as the temperature rises or falls and so the temperature of the soil should be kept constant throughout.

To offset some of the natural drawbacks of the soil burial technique most workers use a range of soils

collected from areas where there is a high degree of local homogeneity. Other workers have used specially prepared "rich" composts. The late Dr. E. Higgins reported[34] the result of his attempt to formulate a synthetic soil, which would allow a high degree of standardisation, but it is clear, from work done in B.D.H. laboratories, that much more work remains to be done upon synthetic soils before an adequate solution to the problem is available.

With all the foregoing factors in mind, it will be seen that even the simple, direct and practical soil burial test must be treated with a great deal of caution before one can hope to deduce the fullest possible information from the results it may yield, but if the soil burial is supported by controlled *in vitro* work in the laboratory, the results can have a very valuable indication for the experienced worker.

Table 9.

Dichlorophen content of cloth	% Residual strength — Soil burial period		
	3 weeks	6 weeks	9 weeks
0·5%	100	55	10
1·0%	100	93	59
1·5%	100	100	97
Control	0	0	0

The results in Table 9 were taken from a paper by Abrams[35] and show the data obtained using dichlorophen-treated 10-oz. cotton duck. Referring again to the work of Block[36] we find the following comparison of various common fungicides:—

Table 10. The % Residual Strength of 10-oz. Cotton Duck after Soil Burial

Compound	1 week	2 weeks	3 weeks
Control	31	nil	nil
Copper naphthenate ..	69	46	nil
Copper-8-quinolinolate	67	34	5
Hg. pentachlorphenate ..	72	8	nil
Pentachlorphenol ..	54	nil	nil
Salicylanilide ..	17	nil	nil
Trimethyl-cetylammonium chlorphenate	36	18	nil
Dichlorophen ..	92	75	25

From Tables 9 and 10 it will be seen that dichlorophen behaves more than adequately under these conditions of soil burial and this observation has been confirmed by other workers in B.D.H. laboratories and elsewhere in Britain and the Commonwealth. These results accord well with those obtained in field trials where the samples have been subjected to the sort of treatment which they might be expected to experience in practice.

Weathering

It is well-known that textile materials are all susceptible, in varying degrees, to the physical effects of weather. The gross result of weathering is due to the combined action of at least four distinct actions—light, heat, leaching and oxidation. Of these effects, the most important is probably that of the action of actinic light which can certainly have an adverse effect upon such materials as cotton and nylon. These climatic attacks are all components of the general action of rotting and it is generally agreed that, ideally, the perfectly rotproofed textile should be protected against these physical conditions, but this has not yet been realised. The British Standards Institution Committee on The Rotproofing of Textiles has stated that "at the present time there are no treatments which give complete protection in all other spheres than the microbiological." To a certain extent, all these physical effects are antagonistic to the activity of micro-organisms, if they are of a sufficient degree of intensity.

The ultra-violet portion of the spectrum is as well-known for its bactericidal action as it is for its ability to degrade cellulose. The red and infra-red portions of the spectrum offer a definite encouragement to the growth of micro-organisms at the lower levels of intensity, but can certainly create an unfavourable environment for them at higher levels. Rain and heavy dews will favour the growth of micro-organisms by leaching out the mildew-proofing compound, but in other circumstances can dissolve away the water-soluble pentosans and sugar-like materials upon which many microbes depend for their sources of food.

It will thus be seen that the perfect rotproofing chemical needs to possess a host of diverse properties, many of which are mutually incompatible. Many compounds which can absorb and nullify the action of ultra-violet light do so by re-emitting it within the visible spectrum or by suffering some kind of configurational modification: in either case one is likely to find that in undergoing these reactions the microbicidal properties are diminished.

Dichlorophen offers no protection against the degradative effects of U.V., but it does exert its bactericidal and fungicidal action unhindered whilst being irradiated. Its persistence in the fabric can certainly be improved by the incorporation of a water-repellent finish[37] and there is an extensive literature dealing with its use as an antioxidant; Bickoff,[38] Larsen,[39] and Morawetz[40] have published reports on this latter property.

Application of Dichlorophen to Cloth

The best method for impregnating a fabric with a protective chemical will depend on its chemical and physical properties, especially the pH value at which it becomes soluble or insoluble and the conditions under which it shows affinity for a textile fibre. Because of its phenolic hydroxyl groups, dichlorophen has a good substantivity towards protein fibres and can also be satisfactorily applied to cellulosic fibres and the following paragraphs are devoted to a description of the methods usually employed.

The impregnation techniques suitable for use with dichlorophen can be broadly grouped into three categories: (*a*) aqueous technique, (*b*) emulsion technique and (*c*) solvent method.

Aqueous Technique

In this technique, use is made of the fact that dichlorophen forms water-soluble sodium, potassium, ammonium and calcium salts which can be applied to the fabric and later fixed in a suitable souring bath. For the industrial scale it is now possible to obtain the sodium salt of dichlorophen in the form of the 40% solution: this form of dichlorophen can be applied on almost any impregnating machine, whether it be of the cyclic, immersion, or padding type. A suitable dilution of the dichlorophen solution is prepared after consideration of the percentage pick-up of the fabric and the desired final content of the microbicide in the finished cloth; as there are so many individual variations of procedure within the industry and such a variety of machinery available it is probable that the exact concentrations to be employed may be best arrived at by consultation with the manufacturers of the dichlorophen. After applying the solution the treated cloth is then passed through a bath of acetic acid solution (3 - 5%) to precipitate the free dichlorophen in the fabric; the concentration of acid used must be such that the soured cloth leaves the nip of the rollers in an acid condition. This ensures that all the sodium salt of dichlorophen is converted to its insoluble phenol; the fabric is then dried in the normal manner, when any residual acetic acid should be removed.

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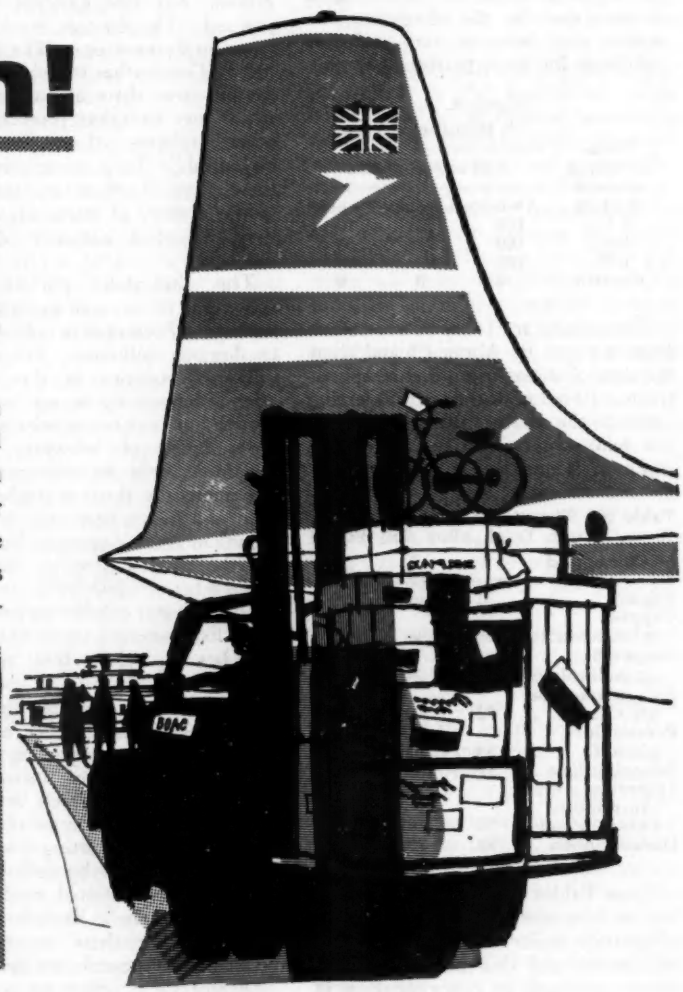

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The temperature of the first bath is important when cellulosic fibres are being treated so that the best substantivity is obtained. The optimum temperature will usually be within the 55° to 75°C. range, depending whether the material is in the sliver, yarn, grey or bleached stage and the degree of cuticular damage sustained in the fibre. Wool can be impregnated at any convenient temperature because the dichlorophen is held at the basic sites on the protein molecules. The aqueous technique can easily be adapted to fit in with waterproofing processes.

In general, the alkaline solutions of dichlorophen do not impart colour to the cloth, but if it is intended to use concentrations well above the normal and if the final whiteness of the fabric is critical, one would be well advised to use the especially pure grades which are supplied. At the B.S.S. higher level of 1·3% the ordinary commerical grades do not significantly colour the cloth.

Emulsion Technique

The application of dichlorophen in the form of the free phenol from an aqueous medium is frequently described as an emulsion. An emulsion is more correctly described as the dispersion of an oil or other immiscible liquid in water and conversely; we shall deal with that form first and the powder dispersion later. The latter, although included here for convenience is, of course, by definition, not an emulsion.

When preparing emulsions of dichlorophen use is made of the fact that it is soluble in various oils; the dichlorophen is dissolved in a suitable oil and an emulsion is then formed by the incorporation of water in the presence of an emulsifying agent. The following formulation should serve to illustrate the principles of the process:—

25 lbs.	.. Dichlorophen
12·5 galls.	.. Pine oil
12·5 galls.	.. Water
10 lbs.	.. Perminal (I.C.I.)

Dichlorophen is soluble in pine oil and a solution is prepared by stirring the two components together with gentle heating; in some cases it may be necessary to filter the oil solution. The emulsifying agent (Perminal) is dissolved in the 12½ galls. of water—again with the aid of gentle heat. Formation of the final emulsion is assisted by keeping both the oil and aqueous solutions at roughly the same temperature (180°F.). The dichlorophen solution is slowly added to the emulsifying solution with continuous thorough stirring. This process yields an oil-in-water emulsion which may be diluted with water as required.

This emulsion is quite satisfactory for applying dichlorophen to any fabric, but it cannot be recommended for treatments which will have to withstand severe leaching conditions; in these cases it can be incorporated with a water repellent treatment. The dispersion formula may be prepared by slowly adding an alcoholic solution of dichlorophen to an aqueous solution of some suitable non-ionic surfactant, such as "Abracol." The dichlorophen is precipitated from the alcohol (usually isopropanol) as the solution is added to the water and is held in suspension by the dissolved emulsifying agent. Constant stirring prevents sedimentation. This formulation too, is unsuitable for use upon fabrics which are expected to withstand severe leaching.

Solvent Technique

The impregnation with dichlorophen by means of organic solvent solutions offers several advantages to processors who are equipped to handle solvents and are able to cater for their eventual recovery in the drying process. The use of dichlorophen in organic solvents enables one to treat cloth whilst still in the roll with a fair expectation of even distribution throughout the material; it is a process which lends itself well to the methods of the dry-cleaning trade. Since the most convenient organic solvent is probably white spirit it might be as well to consider the best method of preparing dichlorophen solutions of practical strength. Dichlorophen is not very soluble in white spirit (see Table 2) but solutions of 10% and over may be obtained if the dichlorophen is first dissolved in a small amount of polar solvent:—

A 10% solution of dichlorophen may be prepared by first dissolving 100 g. dichlorophen in 100 ml. of a 50% v/v acetone/I.P.A. mixture and then pouring into a well-stirred 900 ml. of white spirit B.S.S. 245.

The emulsion or solvent techniques may be used in conjunction with coating processes, such as rubber or P.V.C., and, in the suitable form, may be incorporated into the coating mixture or impregnated directly on to the fabric before coating. Dichlorophen is completely compatible with rubber and has formed the subject of a Dunlop patent for the preservation of rubber.[41]

Range of Uses

Since the full potentialities of dichlorophen were first realised by the textile industry, it has been included into more than 40 military specifications covering the manufacture of the following materials:—[42]

(1) Wool felts.
(2) Hair felts.
(3) Rubberised fabrics.
(4) Webbings.
(5) Threads.
(6) Hospital sheeting.
(7) Twines.
(8) Cotton duck.
(9) Cotton twill.
(10) Fabrics for electrical equipment.
(11) Rope.
(12) Jute.
(13) Manilla fibres, etc.

It has been included in the revised edition of British Standard Specification No. 2087 as a mildewproofing agent for general use. As the applications for dichlorophen have become more numerous and diverse, the scale of production has increased to keep pace with the demand and it is now produced upon a multi-tonnage scale in this country.

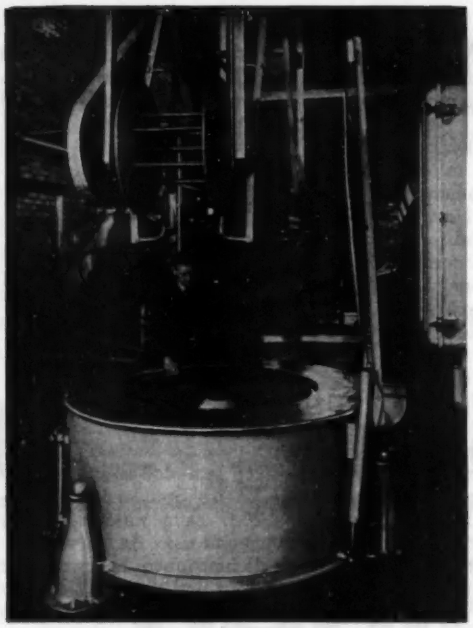
The most recent development in the use of dichlorophen has been the Comprox/Panacide sterilising technique evolved by B.P. Detergents Ltd. and British Drug Houses Ltd. for sterilising hospital blankets in the laundry. This sterilising process has been tested in hospital laundries for several months and has given consistently good results at a cost which makes it of interest to the textile industry in general and to the wool industry in particular.[43]

Miscellaneous Applications of Dichlorophen

In this section we summarise the other applications of dichlorophen in the textile industry.

Water Treatment.—From extensive work in the paper industry in this country and Canada, we have been able to devise methods for eliminating and preventing the growths of slime-forming micro-organisms in water systems and cooling towers. The low toxicity of dichlorophen towards fish reduces the danger of river contamination to a controllable minimum.[44]

Size Preservation.—The storage of sizes in solution is often complicated by the tendency which these materials have to encourage the growths of bacterial and fungal species, with the result that spoilage frequently occurs. The inclusion of 0·3% dichlorophen into the mixture will ensure that the size will remain fresh and free from odour for considerable periods. It is



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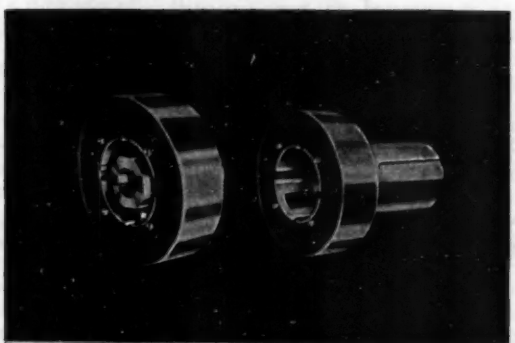

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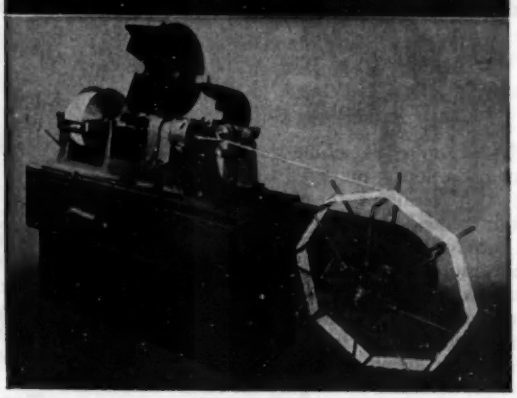

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possible to incorporate the dichlorophen into the size at a sufficiently high level to prevent mould or bacterial defacement of the finished fabric.[45, 46]

Walls.—In mills where a constant high relative humidity has to be maintained, it is frequently found that fungal growths will form upon the walls of the building: these may be removed and prevented by treating with dichlorophen.

Humidifiers and Air Conditioners.—Humidifiers and air conditioning plant are susceptible to bacterial growths which can seriously impede their efficient operation: dichlorophen is widely used in such plants with useful result.

Anti-corrosive Hessians.—The practice of wrapping subterranean pipes in hessian tapes may be enhanced by the inclusion of suitable levels of dichlorophen. The proved activity of dichlorophen against the sulphate-reducing bacteria constitutes a valuable weapon against this most common reason for underground corrosion.

* * *

In this paper we have outlined the applications which have been discovered for dichlorophen in the textile industry. The literature is extensive and cannot be comprehensively treated in such a limited compass, but it is hoped that a sufficiently wide selection has been made to indicate its known potentialities and, perhaps, to suggest future developments. The authors would be interested to receive suggestions or enquiries in this field.

Acknowledgments

The authors thank Dr. C. Ockrent, Director, British Drug Houses Ltd., for advice and permission to publish the results contained herein.

References

(1) **Rose, Fraser and Bayley: Amer. Dye. Rep., 46, June, 1957, No. 11.**
(2) **Morawetz: Ind. Eng. Chem., 41, 1442, July, 1949.**
(3) **Bickoff: J. Amer. Oil Chem. Soc., 1951, 28, 65-8.**
(4) **Larsen: Ingenioren, 58, 95-98 (1949).**
(5) **Benk: Chem. Zeitg., 1955, 79 (10), 337.**
(6) **British Veterinary Codex, 1953.**
(7) **Singer, Stern: Anal. Chem., 1951, 23, 1,511-2.**
(8) **Shiraeff: Amer. Dye. Rep., 1954, 34, 15-16.**
(9) **Gottlieb and Marsh: Ind. Eng. Chem., Anal. Edn., 1946, 18, 16-19.**
(10) **Bolle and Mirimanoff: Pharm. Acta. Helv., 1951, 26, 284-90.**
(11) **Willard and Thompson: J.A.C.S., 1930, 52, 1893-7.**
(12) **Clements and Newburger: J. Assoc. Offic. Agr. Chemicals, 1954, 37, 190-7.**
(13) **Reissman (private communication "Antiseptics, Disinfectants, Fungicides and Sterilisation" by Reddish, published by Kimpton, London, 1954, p. 255).**
(14) **Marshall and Feinsilver: U.S. Quartermaster's Depot.**
(15) **Waksman *et al.*: Report (unpublished) U.S. Off. Sci. Res. Dev. Report No. 4101. 3rd Edn., July, 1944.**
(16) **Florestano: J. Pharmacol. Exp. Therap., 1949, 96 (8), 238-49.**
(17) **Craige and Kleckner: N. Amer. Vet., 1946, 27, 26-30.**
(18) **Ryff and Honess: J. Amer. Vet. Assn., 1953, 122, 216-20.**
(19) **Marsh, Greathouse, Butler and Bollenbacher: U.S. Dept. Agric., Tech. Bull., No. 892 (1944).**
(20) **Marsh and Butler: Ind. Eng. Chem., 1946, 38 (7), 701-5.**
(21) **Dr. Postgate, D.S.I.R., Teddington (private communication to author).**
(22) **British patent to I.G. Farben, No. 316900.**
(23) **Luttringhaus: Amer. Dye. Rep., 37, 57, January 26, 1948.**
(24) **Luttringhaus: "Textile Chemicals and Auxiliaries," Ed. Speel, Chap. 22, Reinhold, New York, 1952.**
(25) **U.S. Dept. Agric. Bureau of Entomology and Plant Quarantine, E-707, 1946.**
(26) **Borghetty: Rayon Tex. Mon., 26, 479, September, 1943.**
(27) **Goodavage: Amer. Dye. Rep., 1943, 32, 265-70.**
(28) **Shanor: "Fungus Proofing of Textiles and Cordage for Use in Tropical Service," U.S. Off. Sci. Res. Dev., Report No. 5413, January, 1945.**
(29) **Unpublished work at the microbiological laboratories of British Drug Houses Ltd., London.**
(30) **Erlandson and Lawrence: Science, 118, 274, September 4, 1953.**
(31) **Watkins and Klemme: Amer. Journ. Botany, 35, 622, November, 1948.**
(32) **Barker and Marsh: "Preliminary Report on Sensitivity of Fungi to Cotton Fabric Preservatives," U.S. Bureau of Plant Pathology, Industry, Soils and Agric Eng.**
(33) **Siu: "Microbial Degradation of Cellulose," published by Reinhold, New York, 1951.**
(34) **Higgins: Jour. Tex. Inst., January, 1958.**
(35) **Abrams: "Microbiological Deterioration of Organic Materials, Prevention and Method of Test," Misc. Pubin. No. 188, U.S. Nat. Bur. Standards, Washington, D.C., November 1, 1948, ORR 75/51; PB 99,549.**
(36) **Block: Ind. Eng. Chem., 1949, 41 (8), 1783-9.**
(37) **U.S. Patent 2,468,068.**
(38) **Bickoff: J. Amer. Oil Chem. Soc., 1951, 28, 65-8.**
(39) **Larsen: Ingenioren, 1949, 58, 95-9.**
(40) **Morawetz: Ind. Eng. Chem., 1949, 41, 1,442-7.**
(41) **British Patents to Dunlop Ltd., No.'s 663, 273; 675,200; 692,150.**
(42) **Various service specifications issued by U.S. Government, available on application to authors.**
(43) **"Comprox/Panacide Blanket Sterilising Technique," jointly published by B.P. and B.D.H. Ltd.**
(44) **"Panacide in the Paper Industry—Slime Control," published by British Drug Houses Ltd., Poole.**
(45) **"Panacide in the Paper Industry—Size Preservation, etc.," published by British Drug Houses Ltd., Poole.**
(46) **"Panacide in the Textile Industry," published by British Drug Houses Ltd., Poole.**

New Companies

Twiss and Robinson Ltd. Private company. Reg. March 3. Capital £6,000 in £1 shares. Merchants and manufacturers of silk, satin, galloons, velvets, velveteens, etc. Registered office: 16 Tariff Street, Manchester 1.

Molnlycke Textiles Ltd. Private. Reg. March 3. Capital £5,000 in £1 shares. Textile merchants and manufacturers, etc. Solicitors: Reynolds, Gorst, and Porter, 7 Arundel Street, W.C.2.

Horbury Scouring Co. Ltd. Private. Reg. March 4. Capital £10,000 in £1 shares. Commission scourers and processers of textile fibres, etc. Registered office: Navigation Mills, Horbury Bridge, nr. Wakefield.

Hewitt Wilson Textiles Ltd. Private. Reg. March 8. Capital £3,000 in £1 shares. Textile and fabric printers and merchants, hand block printers, etc. Registered office: Barclays Bank Chambers, New Mills, Derbys.

Bradfield Waste Co. Ltd. Private. Reg. March 9. Capital £2,000 in £1 shares. Dealers in rayon and synthetic waste of all kinds, cotton and wool waste, etc. Registered office: Bank Mill, Leymoor Road, Golcar, Huddersfield.

Holland and Webb Ltd. Private. Reg. March 14. Capital £5,000 in £1 shares. Silk, yarn agents and general merchants, etc. Solicitors: Tutin and Co., St. Peter's Gate, Nottingham.

Bentleys (Weavers) Ltd. Private. Reg. March 14. Capital £5,000 in £1 shares. Registered office: Cliffe Mills, Great Horton, Bradford.

J. and E. Marsden Ltd. Private. Reg. March 15. Capital £10,000 in £1 shares. Cotton manufacturers and weavers, cotton spinners and doublers, etc. Registered office: Bridgefield Mill, Rishton, Lancs.

Celia Fabrics Ltd. Private. Reg. March 16. Capital £2,000 in £1 shares. Manufacturers and dealers in cloth, wool, worsted, etc. Registered office: 10 Butts Court, Leeds 1.

Citation Ltd. Private. Reg. March 16. Manufacturers and dealers in silk, rayon, cottons, woollens and other textile fabrics, clothing, etc. Registered office: 8 Clifford Street, New Bond Street, W.1.

R. Scarlett Ltd. Private. Reg. March 17. Capital £2,000 in £1 shares. Buyers and sellers of wool and cotton waste, rag, shoddy, clippings and sweepings, etc. Registered office: Bottoms Mill, Salterhebble, Halifax.

Glendyke Mills Ltd. Private. Reg. March 21. Capital £10,000 in £1 shares. Manufacturers and dealers in cloth, wool, etc. Registered office: 1 Concord Street, Leeds 2.

David Gruniss Ltd. Private. Reg. March 21. Capital £1,000 in £1 shares. Manufacturers and dealers in fabrics, curtains and furniture coverings, etc. Registered office: 34 South Molton Street, W.1.

H. Siddle and Sons Ltd. Private. Reg. Feb. 25. Capital £10,000 in £1 shares. Merchants, manufacturers, spinners, dyers and preparers of all synthetic yarns, etc. Registered office: Carter Mills, Cleckheaton Road, Low Moor, Bradford.

F. M. Gosman (Yorkshire) Ltd. Private. Reg. Feb. 29. Capital £400 in £1 shares. Manufacturers and dealers in insulating materials of all kinds, scrim, calico and asbestos cloth mattresses. Converters of cotton goods and knitted goods, etc. Secretary: Gordon V. Graeme, 61 Fairview Avenue, Gillingham, Kent.

B. F. Broadhead (Agency) Ltd. Private. Reg. March 1. Capital £5,000 in £1 shares. Woollen and worsted cloth manufacturers and merchants, etc. Registered office: Lloyds Bank Building, Huddersfield.

Shirley Coward (Goole) Ltd. Private. Reg. March 1. Capital £2,000 in £1 shares. Merchants, spinners, manufacturers, packers, bleachers, dyers, finishers and dealers in flax, hemp, jute, wool, cotton, rayon and other fibrous substances, etc. Registered office: 38 Pasture Road, Goole.

Joyce Fabrics of New York Ltd. Private. Reg. March 2. Capital £1,000 in £1 shares. Merchants, agents, importers, factors, brokers and warehousemen of wools, worsteds, cotton, silk, etc. Registered office: 53 Queen Anne Street, W.1.

Picadex Manufacturing Company Ltd. Private. Reg. March 2. Capital £1,000 in £1 shares. Wool brokers, etc. Solicitors: J. Eaton and Co., Market Street, Bradford.

Hobourn-Roberts Co. Ltd. Private. Reg. March 22. Capital £10,000 in £1 shares. Dealers in textile machinery, parts, accessories and replacements; engineers, etc. Registered office: Wellington Street Extension, Burton-on-Trent, Staffs.

W. H. Hammond and Co. (Manchester) Ltd. Private company. Reg. March 25. Capital £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in textiles, worsteds, yarns, tweeds, cloths, etc. The directors are: William H. Hammond, 253 Brooklands Road, Wythenshawe, Manchester 13; Mrs. June Stott, 5 Turton Street, Higher Openshaw, Manchester 11. Secretary: Mrs. June Stott. Registered office: 26 Richmond Street, Manchester 1.

Jacomb Hoare Ltd. Private. Reg. March 25. Capital £30,000 in £1 (25,000 preference and 5,000 ordinary) shares. Manufacturers and dealers in cloth, wool, etc. Solicitors: Allen and Overy, 9-12 Cheapside, E.C.2.

Walverden Mill Ltd. Private. Reg. March 28. Capital £6,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in textiles and textile fabrics, etc. The subscribers (each with one share) are: Percy O. Ansell and George A. Corderoy, both of 116 Chancery Lane, W.C.2. The permanent directors are: Harry Hartley and Stanley J. Partington.

John Ogden Ltd. Private. Reg. March 29. Capital £20,000 in £1 shares. Objects: To carry on the business of cotton and rayon merchant converters, etc. The directors are: George Clayton and Mrs. Ruby Clayton, both of "Revigney," 58 Mossley Road, Grasscroft, Oldham. Secretary: Barbara Molloy. Solicitors: Lambert and Parker, Burnley. Registered office: Waterton Works, Mossley, nr. Manchester.

John Mills and Sons (Cockington) Ltd. Private. Reg. March 29. Capital £2,500 in £1 shares. Objects: To acquire the business of hand loom weavers carried on at The Mills, Cockington Torquay, as "John Mills and Sons," etc. The directors are: John Mills (Managing Director), Mrs. Margaret S. Mills, Thomas Mills, and Donald S. R. Mills, all of "Tomich Brae," Loxbury Road, Cockington, Torquay. Secretary: Margaret S. Mills. Registered office: The Mills, Cockington, Torquay.

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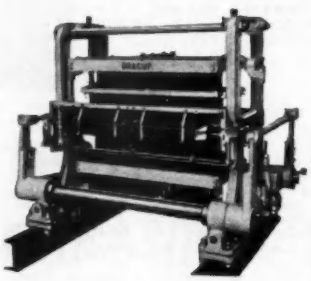

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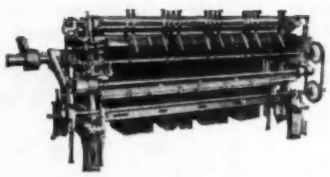

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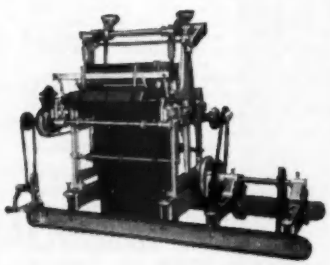

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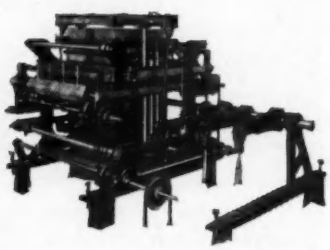

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Society of Dyers and Colourists

Permanent Setting of Wool-Fabrics

IN recent years, garments manufactured from synthetic fibres had been able to retain their appearance after laundering to such an extent that they could be worn without ironing. This had led to the development of an entirely new field of textiles known as "wash and wear," "minimum care," "non-iron" and various other titles. Research on resin finishing of cotton had led to the very successful performance of cotton fabrics in this field and there had been a demand for similar effects in pure wool fabrics, observed Mr. A. J. Farnworth (Commonwealth Scientific and Industrial Research Organisation) in a recent address to the West Riding Section of the Society of Dyers and Colourists.

In addition to the normal fabric properties required for satisfactory garment performance (comfort, wrinkle resistance and recovery, ease of removal of soil, colour fastness, strength, tailorability, etc., all of which are possessed by wool), the major requirements for a washable non-iron garment were dimensional stability and retention of appearance on laundering, and it was in these properties that wool failed badly, he continued. Dimensional stability in the case of wool required some treatment to prevent both relaxation shrinkage and felting shrinkage, whilst retention of appearance necessitated some setting process to prevent the development of mussiness and wrinkles which normally occurred when wool fabrics were laundered. A study of these various factors at the Geelong Laboratory had led to a process for producing washable non-iron wool fabrics.

A great variety of methods had been published for preventing felting shrinkage in wool, but few had been used commercially to any extent. Chlorination procedures had received the greatest acceptance, mainly because of their low cost, but these suffered from the disadvantages of having an adverse effect in colour and handle and requiring strict control for satisfactory results. Work at Geelong, said Mr. Farnworth, showed that in addition to its anti-felting effect, the shrink-proofing treatment played an important role in obtaining the maximum effect from the setting treatment. Hence, although any shrink-proofing treatment could be used in connection with washable non-iron finishes, it should be capable of giving a high degree of shrinkage resistance.

Recently McPhee had published details of an excellent method which gave an adequate degree of felting resistance, without any adverse effect on the fabric and which required very little control. The method was based on the effect of concentrated sodium chloride solutions in protecting wool from degradation and involved treatment with potassium permanganate in such salt solutions, followed by a clearing treatment with sodium bisulphite. No analyses were required on the re-agents used or on the shrink-proofing liquors. The permanganate treatment was finished when the pink colour of the solution had disappeared, and the clearing treatment was over when all residual manganese dioxide had been removed from the wool. For economy, the salt solution should be used as a standing bath and this had raised no difficulties in practical trials where the same bath had been used for ten consecutive treatments. Between 4% and 6% potassium permanganate on the weight of wool was sufficient with the vast majority of fabrics but only exactly similar pieces should be treated simultaneously as, under given conditions, some fabrics reacted with permanganate much more rapidly than others. Some colours were affected very slightly by the treatment, and if goods were to be piece dyed and exactly on shade it was better to shrink-proof before dyeing. This method gave a high degree of shrinkage resistance and was recommended for fabrics intended for subsequent setting to obtain washable non-iron effects.

From the distortion and mussiness of normal wool fabrics after mild laundering and in some cases, even after wetting, it was obvious that a setting treatment was required to set wool fabrics in a flat state to which they would return after wetting, washing and drying. It had been observed that in Si-Ro-Set garments, not only were the creases retained after wetting and drying, but the flat portions also retained their appearance. An obvious procedure, therefore, was to apply the Si-Ro-Set treatment to garments made from shrink-proofed fabrics. This was found to give very encouraging results, but such a method would be limited to trousers and pleated skirts whereas a more general application was required in which the treatment is applied to fabric in the mill, and from it such garments as frocks, blouses, shirts, straight skirts and children's wear could be manufactured. However, these experiments did show that the same general procedure could give satisfactory results—i.e., heating wool in the presence of a dilute solution of a reducing agent while holding it in the desired form.

Application

The two major requirements for mill treatment of fabric, therefore, were (*a*) even application of a controlled amount of water and reducing agent and (*b*) some means of holding the fabric firm and flat whilst applying heat. Experiments were carried out using a pad mangle to satisfy the first requirements and a blowing machine for the second, and varying the concentration of reagent, uptake of solution, steaming time, etc., in order to define the optimum conditions for fabric setting. These were found to be (*a*) 1% solution of reducing agent, (*b*) 50% uptake of solution, (*c*) 5 mins. steaming at 80 lb./in.^{2} line pressure. Many shrink-proofed fabrics were set under these conditions and evaluated for non-iron properties, both as fabric and as garments. The results obtained were very satisfactory and warranted further investigation on an industrial scale. However, it was first necessary to decide on the most suitable reducing agent for the purpose.

Although ammonium thioglycollate had several advantages which led to its use for the Si-Ro-Set process, the cost, high rate of oxidation and discolouration by traces of iron were major obstacles to its use in textile mills. Although any reducing agent capable of giving rapid breakdown of some disulphide bonds would be suitable, sodium bisulphite had much to commend it for industrial use and, in addition, was well-established as a potential setting agent for wool from the work of Professor Speakman at Leeds University. It was decided, therefore, to use this reagent for setting fabrics on an industrial scale.

The shrinkage occurring when wool fabrics were relaxed in water was known as relaxation shrinkage and was considered to be due to release of yarn and fabric strains imparted during manufacture. The amount of shrinkage varied considerably between fabrics but could be as high as 5%, which was far too great for a garment that was to be washed and worn without pressing. It was obvious, therefore, that steps had to be taken to ensure that fabrics were finished free from strain.

Experiments showed that the setting treatment could be carried out at the end of the finishing routine (i.e., after cropping, brushing, etc.) and the only subsequent treatment necessary was dyeing, followed by a light steaming on the blowing machine. After wetting with bisulphite solution and steaming during the setting treatment, the fabric was in a completely relaxed state so that, provided no strains were introduced after this stage (i.e., in drying and final blowing) the fabric should be free from relaxation shrinkage. Experiments showed that this was indeed the case.

Dyeing, etc., Processess

Dyeing and printing was probably the greatest problem encountered because of the many fastness requirements. Obviously for satisfactory garment performance, the dyes used must have good fastness to light, perspiration, rubbing, and washing. In addition, however, the dyes must be stable to the shrink-proofing treatment if dyed before proofing, or capable of being dyed level after shrink-proofing if this routine was preferred. Finally, as setting should be the last wet process, they must be stable to the setting process, and this involved two separate factors:—

(1) Stability to water at high temperatures; although a wash fastness of 4 would be satisfactory for garment washing, it was found that colours of wash fastness 5 were necessary to avoid bleeding of colour on to the blowing wrapper.

(2) Stability to sodium bisulphite. No dye manufacturer's fastness tables gave this information, but it had been found that dyes with a fastness of 5 to sulphur stoving were generally unchanged by the bisulphite treatment.

No difficulty was experienced in finding dyes with satisfactory properties for stock or top dyeing, as levelness is not so critical. However, dyes which were stable to shrink-proofing should be selected. For piece dyeing, no difficulty had been

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experienced in dyeing level after shrink-proofing with permanganate, but the only class of dye which met all the requirements was the neutral or weakly acid-dyeing premetallised colours. This class did not give a complete range of shades but could be supplemented in the blues and greens by one or two individual members of other ranges. For bright shades, however, these were not suitable and it was necessary to dye with colours of appropriate properties. No difficulty was experienced in selecting dyes for printing because printing could be quite satisfactorily carried out after shrink-proofing and setting, so the only requirement other than the usual ones for outerwear was suitable fastness to washing.

The pH of the fabric before setting was found to be very important. The optimum pH for setting with bisulphite is 5; if it was less than 4 setting was ineffective, all the bisulphite being decomposed, whilst above pH 6 it was found that some fabrics became stiff during the setting treatment. This stiffening could be removed by some mechanical treatment such as squeezing between rollers, but it was preferable to avoid the effect by bringing the fabric to pH 4 - 6 prior to setting. Although it was not easy to adjust a batch of fabrics of this range, pieces dyed with the type of dye recommended above and using mono-ammonium phosphate as the dyeing assistant, had been found to be at the correct pH. For pieces shrink-proofed after dyeing, the use of acetic acid in the bisulphite clearing bath, followed by adequate rinsing, left the piece at the correct pH for setting.

In conclusion, Mr. Farnworth referred to two points. First, he did not believe this was the only approach to washable non-iron wool fabrics. Other methods and techniques would undoubtedly be developed for achieving the same end results, with possibly fewer difficulties than those outlined above. However, he did believe that the methods described were practical and capable of being used by manufacturers—in fact, some Australian mills were already using them on a normal production basis, and the resultant fabrics performed equally as well as any wash-wear fabrics available commercially at present. Secondly, satisfactory wash-wear fabrics did not automatically give satisfactory wash-wear garments. There were many problems associated with the design and construction of garments which did not become distorted on washing—seam structure, sewing techniques, etc. These problems were common to all wash-wear garments, irrespective of the fabric from which constructed, and wool fabrics would not be an exception.

New Flame-Resistant Finish

A new and improved flame-resistant finish has been under active development in the laboratories of Proban Ltd., 1 Knightsbridge Green, London, S.W.1. The new finish, which has been on evaluation trials on mill scale for the past two years, can be applied to all normal ranges of cotton, nightwear and party frock fabrics that are predominantly cellulosic in structure; no baking is required.

Pointing out that the new finish does not impair the handle of fabrics, the company state that the original Proban finish involved essentially the application to fabric of THPC and urea in the presence of a melamine-formaldehyde formulation and triethanolmine followed by drying, baking and washing-off. This finish suffered from a number of disadvantages, they say, largely in processing. Great care was necessary in the selection and development of fabrics that would be suitable to carry the finish in order to avoid a harsh handle and loss in tear strength.

The new finish is obtained by applying a pre-formed phosphorus-nitrogen mixture to the fabric and producing a polymer by chemical curing instead of by the more usual method of heat curing or baking. The polymer produced in this way has a completely different physical form from that produced by the original finish and it is claimed that the fabric handle, strength and elasticity are not affected. The polymer contains a higher relative proportion of phosphorus than when a melamine-formaldehyde binder was used so that a lower total weight add-on is required than with the original finish. This also helps to preserve the physical properties of the fabric.

Because it does not affect fabric handle and strength, Proban state, the new finish is of a much wider application than the original finish. Lighter fabrics can be processed and more rigid and tightly woven constructions can be treated provided they can be made sufficiently absorbent to ensure a good penetration of the finishing solution. With tight fabrics some firmness of handle may be obtained but this generally responds to after-softening treatments.

The new finish is applicable to cotton fabrics and blends of cotton with spun viscose rayon providing the proportion of viscose is not more than 50%. It has not yet been found possible to obtain satisfactory finishes on all-viscose or predominantly viscose fabrics. With the new finish as with the old, when the Proban-treated fabrics come into contact with a flame, there will be local charring, but no rapid spread of flame. An important aspect of the finish is that in addition to conferring these flame-resistant properties, there is no smouldering or "afterglow" such as is commonly noticed when burning materials are extinguished.

Compact Continuous Level Indicator

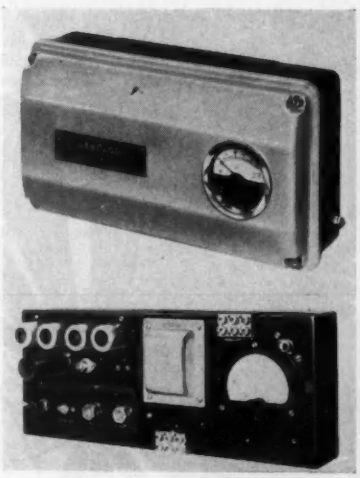
DESIGNED for the continuous measurement of almost any material stored or contained in tanks, hoppers and other containers generally used in industry the "Levolog" continuous level indicator is capacitance operated. The control unit is used in conjunction with an electrode system fitted into the container and the incremental change of capacitance caused by the material rising or falling in the container is used to operate an indicating instrument which may be calibrated in gallons or tons or whatever unit of measurement is applicable. Basically, the equipment consists of:—

(1) The control unit which houses the necessary electronic equipment and a stabilised power unit which ensures stable working under varying mains conditions. A Calibration meter is fitted and is visible at all times through a window in the lid of the case.

(2) The electrode system which can be of the rigid variety for small vessels and of the flexible variety when the depth of the container is in excess of 6 ft. The limitation of length of electrode is really dependent upon the particular application of the material in use, but it can be up to 60 ft. in length.

(3) The main indicating instrument basically a d.c. milliameter is provided for local or remote indication to customers' requirements.

The "Levolog" is housed in a specially designed robust cast iron case the lid of which is fitted with a rubber gasket making the enclosure dustproof and weatherproof. Three ¾-in. conduit entries are provided on both top and bottom of the case. The equipment has for the last nine months been evaluated in industry extensively and can be supplied for use on all standard mains voltages. Full information available on request to Thomas Industrial Automation Ltd., Station Buildings, Altrincham, Cheshire.



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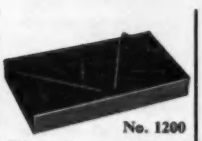

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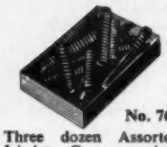

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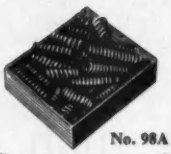

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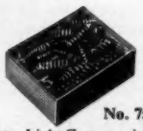

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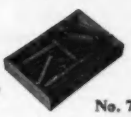

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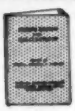

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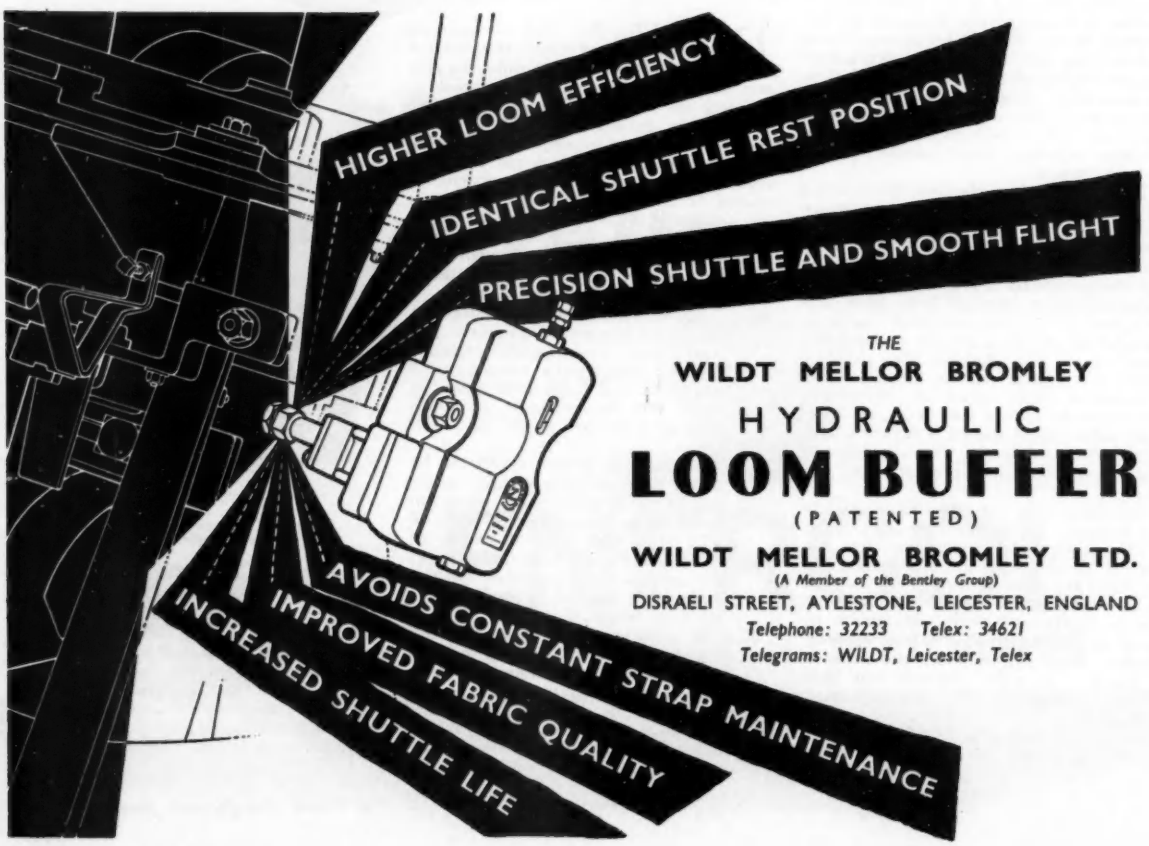

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Textile Trade and Prospects

Raw Cotton, Yarn and Cloth Markets

The world cotton crop for 1959-60, estimated by the U.S. Department of Agriculture at 47·5 million bales (500 lbs. gross weight) will set a record for the second successive year. This crop exceeds the 1958-59 figure by 3·2 million bales or 7% and is 8·7 million bales above the average for the five years 1950-54. Although, as the Department points out, production is again at a new high, cotton consumption continues to rise and, on world basis, consumption may exceed production this season by a small margin and result in a reduction in stocks for the fourth consecutive season. Nearly all of the 1959-60 crop in Northern Hemisphere countries has been harvested and moved into domestic and export markets and harvesting in most Southern Hemisphere countries is now well underway. As the season progressed, there have been upward adjustments from the October 1959 production estimates for the U.S.S.R., mainland China, Brazil and several other countries. Adverse conditions resulted in lower estimates for India, Argentina, and Nigeria.

In the U.S., the 1959 crop totalled 14·5 million bales according to the March, 1960 ginnings report of the Bureau of Census. The average staple length of the 1959 crop was 1⅛ ins., the same as last season's record average and the proportion of cotton stapling 1 1/16 ins. accounted for 42% of total upland ginnings—the highest proportion on record. Harvested acreage in the U.S. was estimated at 15·2 million acres.

Extra-long staple cotton production in the free world this season is now estimated at 1·9 million bales, down 3% from 1958-59. Much of the decline is in the Egyptian Karnak variety. Production of the Menoufi variety (plus a small quantity of Giza 45) has increased steadily in recent years in Egypt to a total of 853,000 bales in 1959-60. Egypt's 1959-60 production of all extra-long staple cotton is down 129,000 bales or 11% from a year earlier but production of other varieties is larger and the total crop is up slightly despite smaller acreage. Production of Sakel-type cotton in Sudan is expected to total about 610,000 bales this season, up 16% from 1958-59. Planting of the 1960-61 crop is already under way in many Northern Hemisphere countries. Recent reports indicate more acreage outside the U.S. will be planted to cotton in 1960-61 than in 1959-60 and that production will increase, perhaps, by as much as 1·0 million bales.

In Lancashire trading circles business has not been quite as brisk in the past week or so. What anxieties firms had about future supplies of yarns and cloths have now largely disappeared as these difficulties were quickly resolved. An increasing amount of shift working has alleviated the position materially and most order books—although quite healthy—are not tending to lengthen still further. Practically every count and quality has been dealt in, the bulk of business being put through in standard weaving qualities, medium counts, on cop, ring-beams, cone and cheese. Fine counts are still in fairly good request, a better tone being noticeable in doubling wefts. Hosiery numbers are readily absorbed, as also are specialities such as core yarns and fancy novelty effect types. Most condenser yarns sell quickly.

The general atmosphere has been quieter in cloth negotiations. Interest is still very good but there is not the same urge to finalise inquiries. Sales have covered a wide range of cloths but the total turnover has been in smaller quantities. Some people incline to the view (repeatedly mentioned in these columns) that the scrapping plan has been too haphazard, in that there are not now sufficient looms for certain types of fabrics. Encouraging business has been put through for a wide range of apparel cloths. Dobby, jacquard, roller and screen printed patterns have all been well supported. Most furnishing fabrics in the medium price brackets sell without much pressure at the moment. Export interest has also been slightly better in both yarns and cloths.

Wool Production and Consumption

Australia's wool cheque for the first nine months of this financial year was £64 million more than last year's return for the comparable period. The total for the nine months was £239·2 million. Biggest buyer was Japan, with purchases totalling £52·8, million—£15·2 million higher than last year's figure. Britain was next with purchases totalling £44 million, an increase of £4 million. France's purchases of wool were valued at £25·6 million, and Italy's £23·2 million. The Soviet Union, which operated in the Australian market for the first time since the resumption of diplomatic relations, bought wool valued at £8 million. Australia's first exchange dealing with wool futures has now been officially opened in Sydney. The exchange allows buyers and sellers to contract sales of greasy wool for later delivery before the wool is actually clipped. Its purpose is to ensure against undue price fluctuations. The only other greasy wool futures exchange is in New York. London, New York, Antwerp, Roubaix (France) and Nagoya (Japan) have exchanges dealing in wool tops.

At New Zealand auctions 152,983 bales of greasy wool were sold during March, making the season total for greasy wool to the end of March some 908,713 bales, compared with 919,235 bales in the corresponding period of the previous season. Although disposals were somewhat smaller than a year earlier, receipts were considerably better as a result of the higher average price at auction this season. Total realised for greasy wool to the end of March was £NZ 57·3 millions, compared with £NZ 44·8 millions in the similar period of last season. Average price so far this season is 45·2d. per lb. against 34·65d. last season. Sales of scoured wool in New Zealand to the end of March were 8,027 bales, producing £NZ519,868; compared with 6,685 bales producing £NZ316,419 last season.

Wool consumption in Britain continues to show a rising tendency, according to the Wool Industry Bureau of Statistics. Rates of wool consumption, top production and worsted yarn delivery in March were 1 or 2% higher than in February. Wool consumption and top production showed similar increases on March last year, while worsted yarns were 13% higher than a year earlier. Wool fabric delivery rate in March was 6% below that of February, but 3% higher than a year ago. Output totals for March were: wool consumption, 45·58 million lbs. (clean weight); top production, 31·96 million lbs.; tops drawn, 21·93 million lbs.; worsted yarns delivered, 22·90 million lbs.; woven fabrics delivered, 32·99 million sq. yds.; blankets delivered, 2·18 million sq. yds. Wool and wool textile exports from the United Kingdom during the 1950's exceeded exports of aircraft and aircraft engines by £800 million, says the annual report of the National Wool Textile Export Corporation. It quotes Board of Trade statistics that the U.K. percentage share of world exports of iron and steel is 12, chemicals 15, machinery 21, and road vehicles 25, but for wool textiles it is 41. Value of British wool textile exports increased more than five-fold in the 21 years from 1938 to 1959 from £30·9 millions in 1938 to £161·6 millions in 1959. The report shows how export advancement in British wool textiles, one of the oldest industries in the country, has been assisted by promotional campaigns conducted on behalf of the whole industry in main markets of the world.

Linen Trade Review

A vague doubt has begun to trouble the minds of some progressive executives in the trade. It is whether the measures being taken to make the industry more competitive, and to revive the prestige of its products in world markets are, in effect, leading in this direction. Events have proved that by no means all of the outlay incurred in re-equipment in post-war years was expended wisely. Too much emphasis has been placed on the need for new equipment, and too little on its ability to meet the needs of a consumer market subject to rapid changes in demand and increasing pressure of competition from an ever-growing number of rivals.

The progressive decline in demand for linen is due mainly to the fact that it is being priced out of practically all its markets, except those for luxury goods. A comparison of recently advertised retail

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As a boxmaker he likes talking to us at Thames Board Mills. He finds we have ready sympathy with his problems and our expertise and knowledge really help him. Even the most intricate boxmaking ideas can be effectively put into production through the use of "Thames Board".

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prices for comparable brands of linen and cotton bed sheets shows the quotations for linen to be approximately 66% above cotton. The extent of this disparity in a highly competitive line explains the declining fortunes of the industry, and points the problem of its rehabilitation.

Peculiarities of fibre structure and limitations of operational speeds in processing methods and machinery of conventional design rule out the possibility of bridging so wide a price gap by possible refinements in existing practice. It demands a radical change in production techniques right from the raw material stage if the industry is to retain its present limited hold in the market for popularly priced goods. For the production of medium and fine yarns wet rove processing offers the best opportunity for cost reduction by permitting the upgrading of raw material and the most economical use of modern equipment. This is finding increasing favour with Continental manufacturers, and merits more serious consideration than it has yet received from British flax spinners.

The volume of inquiries has declined noticeably during recent weeks, as has also the amount of new business placed. Mills and factories generally have cover over the next few months so that there is little likelihood of an appreciable stock build-up before the autumn buying season gets into swing. A welcome feature of the present demand is the cover provided, which extends over the whole yarn count range. Spinners of cambric and prime warp yarns are experiencing some difficulty in obtaining suitable raw material cover, and those who bought short during the 1959-60 season are paying dearly for their mistake.

In West European centres retting is now in full swing and a certain amount of straw is being taken up by the scutch mills. Scutchers, however, are not rushing to cope with the market demand, being more concerned regarding the prospects of the 1960 crop. Consequently supplies of scutched fibre are running below requirements, with prices tending upward, particularly in the higher grades. Disappointment is being voiced regarding the yield and quality of the 1959 crop which has been scutched to date, for which the abnormally dry season is held mainly responsible. The considerable sowing of white flower strains is undoubtedly a contributory factor from the quality standpoint. By reason of their yield potential these continue to find favour with growers, despite the increasing emphasis being placed on quality by the spinner. So long as this lack of co-operation exists between the producer and user the latter must avail himself of every opportunity to upgrade it in manufacture.

The present healthy state of the industry owes much to the lively publicity campaign being conducted by the Irish Linen Guild. There is little doubt that, of the vast sums of money contributed by the trade and Government in recent years to various schemes intended to rehabilitate the industry in its former markets, that expended on Guild activities has, and is paying the highest dividend. The annual summer school conducted by it to educate retail sales staff in the merits of the industry's end products continues to draw attendance from all parts of the home market, including members from executive as well as sales level of the firms represented.

While contraction is still in process within the linen trade the Irish textile industry as a whole continues to expand, new firms coming into existence to produce novel end products, for the most part using man-made fibres alone, or in blends, with those of natural origin.

Jute Fibre, Yarn and Fabrics

Raw jute markets in India and Pakistan became dearer during May and prices advanced rapidly to the highest level since the Korean war. Stocks of raw jute held in Pakistan are now very small and the outlook for the new crop is far from satisfactory. Shippers are reserved and many have been out of the market some time. Offers of fibre are scarce with little prospect of an improvement until the new crop is available. Far Eastern countries secured fair supplies of jute and this seemed to be responsible for the rapid advance in the middle of May. Another factor which caused higher rates was Indian purchases of raw material from Pakistan because of the shortage of her own crop. The present raw material position is serious because of possible shortages before the next crop is ready. A good deal of buying has taken place at high prices and further quantities still have to be secured to maintain yarn production at present levels. It is unfortunate that a short crop should be followed by late sowings due to lack of rain. In Pakistan, sowing of lowland crop is finished and the position is satisfactory. Only about 50% of the middlelands have been completed, however, and sowing in the highlands has still to take place.

As a result of the scare, prices quoted have been irregular with only small quantities available and practically no spot or afloat parcels are to be had. Mill Firsts were offered at £155, Mill Lightnings at £149, Mill Hearts at £143 and grade Hearts at £137, c.i.f. U.K., for May/June and June/July shipment. Grade Tossa-2/3 was at £155 and grade Tossa-4 at £148 with Continental Tossa-2/3 at £142, May/June. E.P.C. values of all grades have been advanced two or three times every week and are about 50% above minimum prices. There is no guarantee that the peak has yet been reached and much will depend on the progress of the next crop. It could be that a period is now being entered where prices of jute and jute goods will be at a much higher level than for some time. So far as overseas spinners are concerned it will be November before bulk supplies of new crop can be received but U.K. spinners hold considerable stocks. Other countries are not so well placed and it may be difficult to maintain output at present levels. This position could bring out buyers for substantial supplies of new crop fibre early in the season which would maintain prices at a high level during the first part of the season. Some sellers have been making offers of old and/or new crop but the discount is small even at the present high values.

Due to the present supply position of raw material the Indian Jute Mills Association has decided to defer the further unsealing of looms. Consideration is also being given to the desirability of curtailing production as from June or July to an extent that will ensure that the availability of raw jute will last until the first arrivals of new crop. Prices of Calcutta goods have advanced rapidly despite the fact that stocks of goods held by the mills at the end of April were at a higher level for both hessians and sackings. Hessian stocks increased by 1,400 tons and sackings by 3,100 tons during the month. Prices quoted were irregular and speculators were operating to a certain extent. Quotations were 75s. for 10 oz. 40 in., and 60s. for 7½ oz. per 100 yds. f.o.b. Calcutta for May and June shipment. "B" twills were 210s. for the same shipment periods. Previously prices were at a much higher level. The much dearer raw material position also left its mark on the prices of Dundee-made yarns and goods. Prices rose three times in the first half of May and on the last occasion by £15 to £20 per ton. This did not halt business and some substantial orders were placed at the higher level of values. Buyers felt they had to make sure of the delivery position and ensure a steady flow of material.

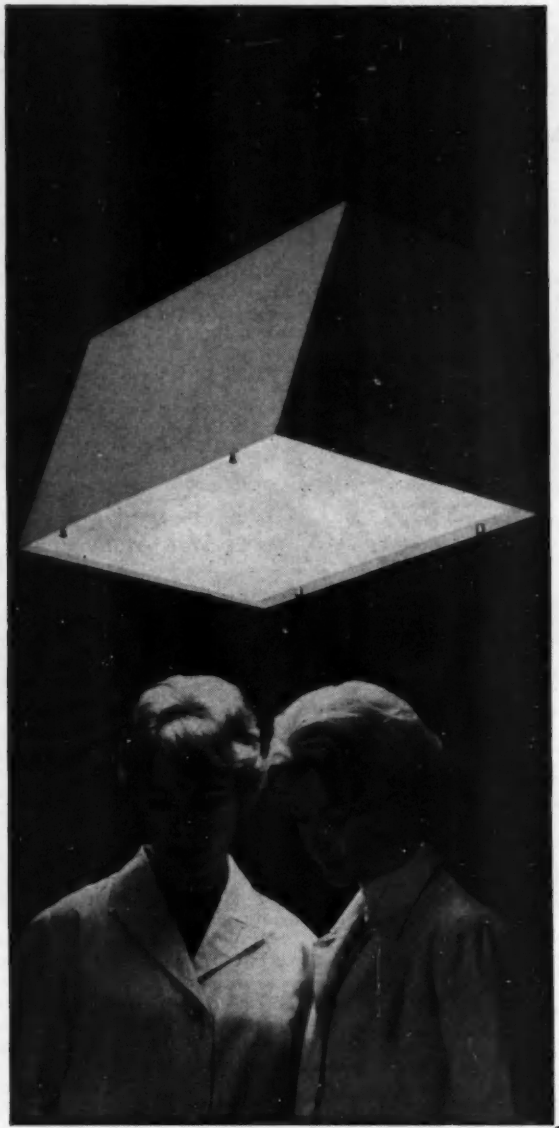
Spinners and manufacturers in Dundee are busy and have orders in hand for delivery well forward. The heavy end of the trade has also found a good demand for tarpaulins and sackings and delivery of certain descriptions of goods is only possible in the forward position.

Silk and Man-Made Fibres

Although pressure of demand seems easier there is still considerable interest in all types of man-made yarns in filament and staple without the tension which has characterised the trade over the past few months. Dope-dyed viscose is being absorbed in excellent volume and there is also a heavy call from carpet manufacturers for viscose and nylon carpet yarns. Most spun yarn blends are selling well. Filament nylon, especially 60 den., is in keen request and "Terylene" spun yarns—100% or in blends—is still in short supply judged by present demand. Order books are still full for months ahead and some merchants are considering the prospects of importing cloth because of the shortage of lines they need. Shift-work in certain mills has alleviated the position somewhat but makers-up, are pressing for early delivery of acetate fabrics and there is unusual interest in narrow acetate linings, also the use of acetate in furnishing fabrics with viscose warp and acetate weft.

In the Yorkshire areas production of blended yarns and fabrics in both the woollen and worsted sections continues at very good levels. Nylon, "Terylene," "Acrilan," viscose and acetate rayons are all being well employed in the production of reasonably priced, attractive cloths. Linings are in very good demand and there had been some thought that a shortage may have developed in filament rayon yarns but there is now little likelihood of this.

Macclesfield and Leek areas seem to be slightly easier so far as nylon and "Terylene" yarns are concerned and throwsters are extremely well booked ahead. Acetate and nylon yarns are being taken up well and as is usual the knitted outerwear trade is insistent on early delivery from worsted spinners of 100% acrylic fibre yarns. In the knitting industry, sales of half hose, including fancy effects, are reported to be high and there is also a good sale this season for girl's brightly coloured stockings.



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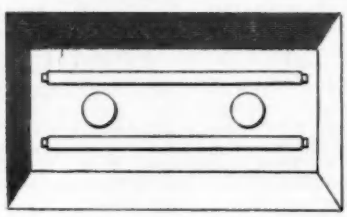

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Notes and News

Scottish Influence on Fashions

Wool tweeds and other Scottish woollen cloths—including many of those previously destined exclusively for the American market—have grown in popularity in Britain during the past year, when deliveries to the home market (11,691,000 sq. yds.) were 1,000,000 sq. yds. up on those for 1958. Speaking recently, in Edinburgh, Mr. J. Ballantyne (president, National Association of Scottish Woollen Manufacturers) said that dollar earnings during the year rose from 9,560,000 to 12,360,000 dollars. Commenting on the American market he said: "While our exports to the United States are much better than in 1958, they are still 25% lower than in 1956 when the tariff quota was first imposed late in the year. Meanwhile, the Japanese and Italians have increased their sales enormously. In 1959 imports of Japanese cloth into the U.S. were nearly double those of 1956 in spite of a self-imposed quota, and those from Italy nearly four-and-a-half times as great. This illustrates the crazy effect of the quota."

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A New Yellow

A new I.C.I. homogeneous reactive dye, Procion Yellow GR, with high tinctorial strength, very good fastness to light and washing, and good fastness to hypochlorite bleaching, is somewhat greener and brighter than its predecessor Procion Yellow R, over which it shows some important technical advantages. Due to its lower affinity, Procion Yellow GR is less liable to show tailing during padding, there is less risk of staining of adjacent materials, and washing-off of unfixed colour is considerably easier. It is expected to find wide use on cellulosic materials, particularly for the production of economical deep red-shade yellows, dark greens in combination with Procion Blue 3R, and in ternary Procion mixtures to give fawns and greys of good stability. The new dye has good batch-dyeing properties, the only factor necessitating caution being the higher-than-usual salt sensitivity of Procion Yellow GR. The main practical implications of this are that Glauber's salt must be used instead of common salt, particularly in jig dyeing, and jig dyeing of heavy shades should be carried out at 40°C. (105°F.) instead of 20-30°C. (70-85°F.).

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Novel Product Aids Dyeing of Acrylic Fibres

Dispersol AFB is a new auxiliary product marketed by the Dyestuffs Division of I.C.I. specifically for the purpose of ensuring level results when basic dyes are applied to acrylic fabrics such as "Courtelle," "Acrilan 16," "Orlon," "Dralon," etc. The new auxiliary, which is in convenient liquid form, acts by restraining the initial rapid absorption of basic dye, allowing the temperature to be raised rapidly to the boil while at the same time promoting uniform uptake of dyestuff by the fibre. It is simply added to the cold dyebath along with the pH-regulating chemicals, shortly before the dye is added. For initial trials the use of 0·5 part of Dispersol AFB per 1,000 parts dye liquor is recommended and will generally be satisfactory.

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Dyestuffs, Finishes, etc. Exhibition

A Textile Dyestuffs, Finishes and Auxiliaries' Exhibition is to be held at the Free Trade Hall, Peter Street, Manchester, on September 22-23 this year. The interest of overseas manufacturers in the British market is reflected by the international nature of the exhibition. In addition to the exhibition, currently, in the Lesser Free Trade Hall there will be a programme of films shown by manufacturing companies and on one of the days, a symposium relating to new developments in textile chemicals.

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Nylon Fair, 1961

The 1961 British Nylon Fair will be held February 6-10, as before, in the Royal Albert Hall, London. This announcement is being made early because of requests from the trade about next year's Fair. B.N.S. welcome enquiries but point out that as they have not yet made any detailed arrangements it is unlikely that space allocations will be made until September 30, 1960.

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Textile Institute Diplomas

The Textile Institute announce the award of Fellowship diplomas as follows:—Dr. D. W. Hill, B.Sc., Ph.D., D.Sc. Director, British Cotton Industry Research Association, Shirley Institute, Didsbury, Manchester 20; Mr. G. Dakin, B.Sc., Assistant Head, Spinning Dept., Shirley Institute, Didsbury, Manchester 20; Mr. A. M. Sookne, B.Sc., M.A., Associate Director, Harris Research Laboratories Inc., Washington 11, D.C., U.S.A.; Dr. E. R. Trotman, M.B.E., Ph.D., M.Sc., F.R.I.C., F.S.D.C., Governing Director, E. R. Trotman Ltd., Nottingham; Mr. H. Wignall, A.T.I., Lecturer, College of Commerce and Technology, Leicester.

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Auction Problems for New Zealand Wool

Wool sold at New Zealand auctions has increased by 30% over the past six seasons —from 918,000 bales in 1952-53 to 1,200,000 bales in 1958-59. Because of the attendant marketing problems, the New Zealand Wool Buyers' Association asked U.K. importers (largest buyers of New Zealand wool) if they would favour the holding of simultaneous sales in the North and South Islands. Under present arrangements no two sales in New Zealand are held on the same date. The British Wool Federation, representing U.K. importers, has replied that an extension of the New Zealand selling season would be preferred to simultaneous sales in more than one centre.

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Wool Production Vital

Stating that the knowledge gained by Australia in 150 years of wool production was available to the world, W. A. Gunn, chairman of the Australian Wool Bureau, says: "Increased wool production is vital if wool is to hold its percentage of the world textile market in these years of fast growing populations." He was speaking in Australia at a presentation to the Peruvian Consul, C. Sullivan, of four Australian Wool Bureau films for use in Peru for educational purposes. They deal with pasture development, sheep parasites, and wool marketing.

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Honours for Bradford Inventors

Two inventors have been awarded honorary fellowships of the Textile Institute. They are Air Vice-Marshal G. H. Ambler, (chairman, F. Ambler Ltd., worsted spinners, Bradford) inventor of the Ambler Super-Draft; and Mr. G. F. Raper, (former director of a Bradford firm) who invented and developed the Raper Auto-leveller. Their inventions, now in wide commercial use, have been described as possibly the most important technical advances in wool textile production since the invention of the spinning jenny.

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Colourspun "Acrilan"

Colourspun "Acrilan" is now available in sampling quantities in 3 den. 2 in. and 4½ in. staple in the following range of colours: black, bronze, sherwood green, blue/green, light, medium and dark blue. Sampling quantities of a further colour, silver, will be available shortly. Colourspun "Acrilan" can be blended by itself or with other fibres in spinning by any of the recognised systems. The extra amounts payable per lb. for colourspun over the standard price of 96d. per lb. for 3 den. fibre are as follows: black 1s. 6d.; charcoal 1s. 6d.; smoke 1s. 6d.; slate 1s. 6d.; silver 1s. 6d.; blue/green 1s. 9d.; sherwood green 2s. 0d.; bronze 2s. 0d.; light blue 1s. 9d.; medium blue 1s. 9d.; dark blue 2s. 0d.

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Greece Joins I.C.F.

The Union of Cotton Industrialists of Greece (Union des Industriels Cotonniers de Grèce) has applied for membership of the International Federation of Cotton and Allied Textile Industries. The application will be considered at the federation's annual meeting in Amsterdam in September. Greece is the only Western European country not yet represented on the International Federation. At present the federation represents 17 countries and approximately two-thirds of the world's total cotton spindles and looms. It enjoys consultative status with the United Nations and provides the only free forum for the cotton and allied textile industries of the world.

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New Appointments

Mr. J. H. Mandleberg (chairman), Brig. L. C. Mandleberg, Mr. M. Leon and Mr. T. Entwistle have resigned from the board of Harbens Ltd., a subsidiary of Courtaulds Ltd., Mr. G. A. Samuel remains a director and Mr. R. J. Kerr-Muir and Mr. H. L. Bingham have been appointed directors, the former becoming chairman.

Speeding-up Freight Traffic

Further steps forward in British Railways London Midland Region's "speed the freight" plan to give, fast and reliable service to traders. Work is to start soon on the building of a new freight terminal adjacent to the present goods depot at Watford. When completed, sundries and full-load traffic now dealt with in the area bounded by Harrow, Harpenden and Great Missenden may all be concentrated at Watford. There will be new offices and amenities for the staff, and the Watford cartage fleet, at present, dispersed to other depots in the area will be concentrated at the new terminal. New sidings will be laid down for marshalling wagons, and two new sheds for received and sundries traffic will be built.

Work has also started on a £1¼ million scheme to remodel completely the marshalling yard at Bescot and this will take about two years to complete. At present, the area between Birmingham, Wolverhampton and Walsall is served by marshalling yards of varying size including those at Bushbury, Stechford, Wichnor and Birmingham Exchange, all of which will cease to be used for marshalling when the new Bescot yard commences operation.

* * *

Plans for Nylon Expansion

The first phase of the Gloucester factory of British Nylon Spinners is now coming into production and will provide increasing supplies of type 66 nylon textile and industrial yarns. A decision has also been made to proceed with the second phase of expansion. This will include further provision for the industrial yarn market, including tyres, and will be in type 6 nylon. Type 66 nylon has advantages for arduous conditions of tyre usage and B.N.S. are increasing production of a new heat-resistant type 66 yarn for tyres. Nylon 6 will have satisfactory properties for most of the general tyre market and, in addition, will show some advantage in the large scale spinning of heavy industrial yarns. The plant is planned to begin production in about fifteen months' time.

* * *

Cotton Plantings

The U.S. Dept. of Agriculture state that planting of the 1960-61 crop is well under way in many northern hemisphere countries. Reports indicate more acreage outside the U.S. will be planted to cotton in 1960-61 than in 1959-60 and that production will increase, perhaps, by as much as 1 million bales. At present, acreage increases are already reported or are in prospect for Mexico, central America, Greece and a number of other countries. A return to more "normal" yields from the adverse conditions in 1959-60 could raise production in such countries as India, Uganda and Nigeria. In Mexico, the area planted to cotton in 1960 is estimated at 2¼ million acres, up 24% from 1959 and the 1959-60 acreage in the Sudan is the largest on record. Plans call for additional acreage to be planted to cotton in the Managil extension of the Gezira. Cotton acreage in Egypt in 1960-61 may be somewhat less than in 1959-60; a decline in Menoufi and Ashmouni acreage is contemplated, while other varieties may increase.

Man-Made Fibre Production

April production of man-made fibres, according to the British Man-Made Fibres Federation, showed a decline from the record level achieved in March, but was over 12 million lbs. higher than last April. April production totalled 49·29 million lbs. compared with 54·64 million lbs. in March and 36·87 million lbs. in April last year. Production of filament yarn totalled 21·24 million lbs. compared with 24·26 million lbs. in March and 18·63 million lbs. in April last year. Output of staple in April was 28·05 million lbs. compared with 30·38 million lbs. in March and 18·24 million lbs. in April last year.

Production (million lbs.)		C.F. Yarn (singles)	Staple	Total
1959 (quarterly average)		58·71	69·77	128·48
1959	1st quarter ..	55·51	67·96	123·47
	4th quarter ..	65·81	79·33	145·14
1960	1st quarter ..	68·29	87·43	155·72

Bonded Fabrics Provide Flared Effect

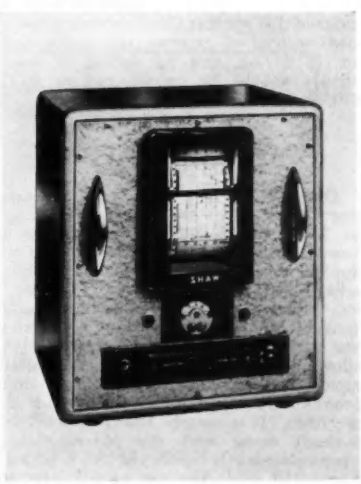
Solena bonded fabrics made by Bonded Fibre Fabric Ltd., Henrietta House, Henrietta Place, London, W.1, are now being used in the production of Susan Small cocktail dresses. Bonded with Hycar synthetic rubber latex, Solena underskirts help to produce the flared effect so essential to summer and cocktail dresses, giving support without weight. They are resilient, washable and resistant to dry cleaning.

Underskirts made with Solena bonded fabrics are used in dresses and cocktail dresses made by Susan Small Ltd. Hycar latex is made by British Geon Ltd., a member of the Distillers Plastics Group.

Two dresses made by Susan Small Ltd., using Solena bonded fabrics

New Recording Hygrometer Alarm

SHAW Moisture Meters, Westgate, Bradford, announce a new recording hygrometer alarm incorporating a new sensing element which enables the instrument to record continuously, the humidity of any atmosphere under pressure or in a vacuum. Giving immediate warning of any alteration in dewpoint, the transistorised alarm needs a minimum of attention and can withstand a pressure of 3,000 p.s.i. It is fully stabilised for 190 to 260 volts, has a response time of 1 second and a chart speed of ½ in. per hour. A notable feature is the instrument's range of approximately 10 million to 1 and dew points down to — 150°C. can now be measured by this reasonably priced, accurate method. The manufacturers state that the instrument is available for a trial before purchase, and delivery is immediate from existing stock.



RECENT TEXTILE PATENTS

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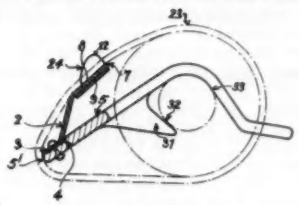
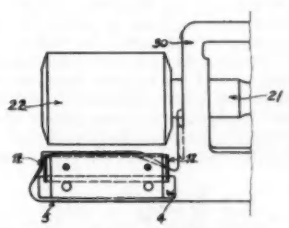
812,335 Double Apron Drafting Arrangements

JOH. JACOB RIETER AND CIE., *Winterthur, Switzerland.*

A cradle for top rolls of double apron drafting arrangements in spinning machines. The cradle rests on an axle 21 of top rolls 22 of a double apron drafting arrangement. The cradle is made of one piece and includes a reversal bar 5 having a rounded front edge 5' on which the run of apron 23 is reversed. The cradle has a central mounting including two symmetric brackets 30 extending from bar 5 and partly surrounding the top roll axle. Each bracket includes an axle retaining flap 31 which is provided with a plane bearing surface 32 the plane of which is at an angle with respect to a plane bearing surface portion 33 of bracket 30. The brackets 30



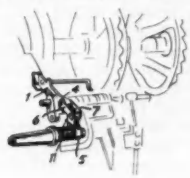


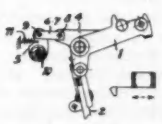
are made of resilient material and are not permanently deformed by the slight bending required for moving the axle 21 between the surfaces 32 and 33 when the axle is mounted. The cradle is provided with a tensioning plate spring 2, the lower part 3 of which is inserted in a recess 4 in the upper side of the bar 5. The upper part 7 of spring 2 has a surface 8 over which the apron slides, the part 7 being so bent that the surface 8 coincides with the upper run of the apron. The apron is guided by a U-shaped piece 9 which is welded to the underside of the portion 7 of the spring 2. In order to reduce accumulation of fly, the flaps 12 of the guide 9 have an inclined front edge 24 at the side where the apron 23 enters the guide piece and, because of this, loose fibres extending beyond the sides of the apron are conveyed by the apron beyond the flaps 12. The spring 2 is narrower than the apron and the marginal portions of the inside surfaces of the apron do not contact the spring 2. The fibres adhering to the edge of the apron are not wiped off by the transverse portion of the guide 9 but are moved upward and out by the guide piece and this prevents accumulation of fly.

812,587 Control of Bobbin Changer-Hammer in Looms

METAPIC S.A., 144 *Rue de Hollerich, Luxemburg.*

In looms having a bobbin changing device the hammer of the bobbin changer is provided with means capable of ensuring rigid control of the length of the stroke, without resorting to a dangerous reduction of the kinetic energy of the hammer, and also without causing a recoil of the latter. The hammer 1 is formed with an additional arm 4, connected with a rocking lever 5 by means of a pair of links 6—7 pivoted as at 8—9. The lever 5 pivots on a shaft 10 which is mounted in an eccentric support, whereby it is possible to adjust the position of shaft 10 by simply rotating the eccentric support. The whole device is urged back





into the rest position by a spring 11. When the hammer is actuated by the fact that the driving bar 2, under the control of the feeler, is placed in the path of the batten 12, the hammer exerts a pull on the rocking lever 5, while causing the pivot axes 8 and 9 to shift until they are in alignment with the axis of the shaft 10, whereby the end of the hammer stroke is precisely determined. Apart from this limitation of the hammer's course, it is also achieved, by the co-operation between the hammer, the links 6—7 and the rocking lever 5, that the hammer, when arrested at the end of its stroke, suffers practically no recoil from said limiting elements. The limit of the hammer stroke may be adjusted with great precision, by adjusting the position of the shaft 10 through simple rotation of the eccentric support of the shaft.

812,644 Improved Packaging of Slivers

T.M.M. (RESEARCH) LTD., *Hartford Works, Oldham.*

Describes sliver cans which are of rectangular plan form and sub-divided by transverse partitions into two or more compartments, such that each compartment may be filled by a coiler delivery with longitudinal traversing movement between the can and coiler. The throw of the coiler is such that the diameter of each coil of sliver is equal to the width of a compartment. The distance between the centre-lines of the compartments is equal to the spindle gauge of the machine to which the slivers are fed, so that a full can may be presented to the spinning machine with a compartment opposite each spindle. This arrangement utilises the whole of the available floor space throughout the length of the machine.

812,697 Decorative Effects on Fabric

BRADFORD DYERS' ASSOCIATION LTD., 39 *Well Street, Bradford.*

An improved process for the production of decorative effects on fabrics composed wholly or mainly of fibres of secondary cellulose acetate and also cellulose triacetate.

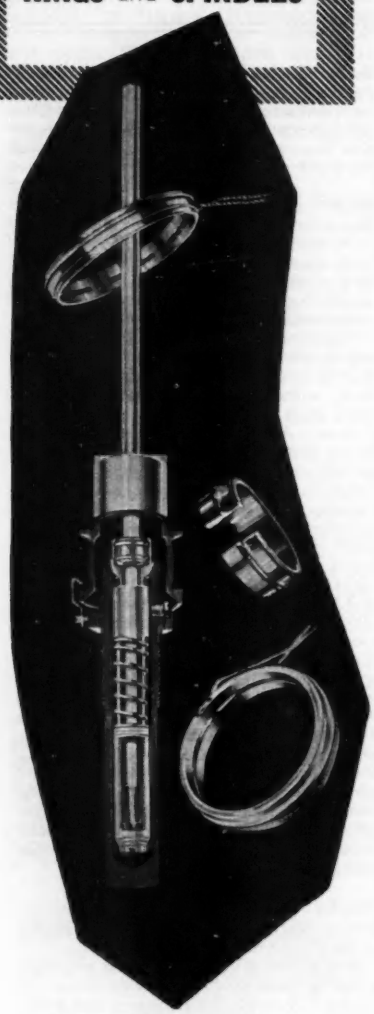
The fabric is first subjected to the local application of pressure, preferably with heat according to a desired pattern, and then, without any saponification, to the application of a dye irrespective of the pattern. A differential dyeing delineated by the pattern is obtained. In one example, an all cellulose acetate crepe fabric is passed between the rollers of an embossing calender. The upper roller is a steel cylinder carrying an engraved design in relief and works against a lower woollen paper bowl. The cylinder is heated to 165°C. and works under an applied force of 2,100 lbs. over the face of the 8-in. bowl. The calendered fabric is then padded in a cold dispersion consisting of 0·2 parts of the disperse dye, 1-methylamino-4-ethylol-aminoanthraquinone, 0·2 parts of "Lissapol N" and 0·2 parts of sodium alginate in 99·4 parts of water. The fabric is dried at a low temperature, steamed at atmospheric pressure for 10 mins. then washed at 60°C. for 30 mins. in a solution containing 0·2 parts of soap in 99·8 parts of water. The fabric now carries a lightly coloured design, where the fabric was pressed into contact with the steel cylinder, on a deeply coloured blue background.

812,756 Improved Wool Comber

PRINCE-SMITH AND STELLS LTD., *Burlington Shed, Keighley.*

A wool combing machine that will have a speed of operation greater than the "Noble" comber. The machine comprises a circle having pins bordering the periphery and projecting parallel with the axis of rotation. Sliver-feeding chutes are translatable relative to the comb circle, that the delivery opening of each successive chute and the periphery of the circle approach one another, pass tangentially to one another and recede from one another, each chute being deflectable perpendicular to the plane of the circle, from a position in which its delivery opening is level with the pins of the circle to a position in which the delivery opening is clear of the ends of those pins. Each chute comprises feed-means for feeding in steps predetermined lengths of sliver, and comb pins project through the sliver, when the sliver is fed, adjacent the delivery opening. Means are provided for rotating the comb circle and for imparting relative translation to the comb circle and sliver-feeding chutes. Each of the several sliver-feeding chutes is

Arunco
RINGS and SPINDLES



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deflected so that the delivery opening is clear of the plane of the ends of the pins of the comb circle while not tangential to the comb circle, and each of the chutes is restored to the position in which its delivery opening is level with the pins of the comb circle when that opening is tangential to the comb circle. Means are provided for actuating the sliver-feed to feed forward the sliver and for projecting the comb pins of each chute into the sliver in that chute while the delivery opening is not tangential to the comb circle. A dabber reciprocates along an axis perpendicular to the plane of the comb circle where the delivery openings are tangential to the periphery of the comb circle between extreme positions. In one position the end of the dabber is clear of the ends of the pins of the comb circle and in the other it penetrates among these pins. Stripping and conveyor means are arranged to pass or be passed by each delivery opening as the latter and the periphery of the circle recede from one another, the stripping and conveyor means being tangential to the comb circle.

812,893 Continuous Bleaching Process

I.C.I. LTD., *London.*

A continuous process for the bleaching of cellulosic fabric which comprises the following stages, each of which is preferably carried out at open width, (i) passing the fabric through a bath of trichloroethylene or perchloroethylene at elevated temperature where it is degreased and dewaxed, (ii) eliminating the solvent entrained in the material by subsequently passing it through hot water, (iii) passing the fabric through a bath of alkaline solution of a peroxygen compound at a pH of at least 10 and subsequently steaming to promote desizing, (iv) saturating it with a solution of a chlorite of an alkali or alkaline earth metal, and finally steaming, the chlorite being activated during the steaming treatment. In one example, a length of grey loomstate cotton duck weighing 7 oz./sq. yd. was passed at open width through a vessel containing trichloroethylene maintained at its boiling point, the time of immersion being 30 secs. The cloth was then passed through water maintained at a temperature of 85 - 95°C. in order to remove solvent, the period of immersion being 20 secs. The cloth was then padded in a solution containing 15 grams/litre of sodium peroxide, 5 grams/litre of sodium silicate and 0·5 grams/litre of a wetting and scouring agent consisting of an octylated cresol condensate with ethylene oxide. The nip of the mangle was adjusted so that the cloth retained approximately 1½ times its weight of liquor. The cloth was next steamed for 2½ mins. and rinsed in hot water, followed by cold water. It was then padded at room temperature in a solution containing 12 grams/litre of sodium chlorite (85% commercial grade) and 5 grams/litre of sulphated fatty alcohol, brought to a pH of 3·5 by the addition of acetic acid, and the nip of the mangle was adjusted so that the cloth retained 1½ times its weight of ilquor. The cloth was then subjected to the action of steam at atmospheric pressure for 15 mins., after which it was rinsed in water and dried. It was then found to be a good white, free from starch and cotton seed. The wettability was excellent and the degree of degradation of the cellulose very low, the fluidity as determined by the standard cuprammonium method being 3·3.

812,894 Dewaxing Vegetable Fibres

I.C.I. LTD., *London.*

A continuous process for treating cloth made from vegetable fibres, to remove waxy, fatty and oily matters and to prepare it for desizing, bleaching, dyeing or finishing processes. The cloth is immersed in open width for a time not exceeding 5 mins. in a bath of trichloroethylene or perchloroethylene, surplus solvent is removed from the cloth which is then passed for a period not exceeding 5 mins., into a bath held at such a temperature as will bring about rapid evaporation of the solvent.

813,051 Improved Cop Winder

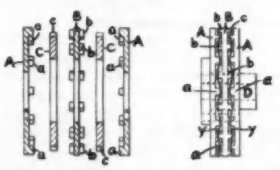
JAMES MACKIE AND SONS LTD., *Albert Foundry, Belfast.*

In a cop winder the yarn, after passing through a tensioner, is laid on the nose of the cop by an oscillated traverse member which applies a frictional drag to the yarn near the point at which the yarn is laid on the cop. It also defines for the yarn a sinuous path, the character of which does not vary even when the direction of a movement of the traverse member is reversed. The sinuosity may vary from instant to instant so that the magnitude of the drag does not vary at the instant of change of direction of movement of the traverse member and which, while it may vary during the traversing cycle, is always substantial.

813,409 Non-Slip Rollers for Feeding Yarn

FINE SPINNERS AND DOUBLERS LTD., *St. James's Square, Manchester.*

Improved rollers for delivering yarn, the roller being of the type having one or more sinuous grooves to receive the yarn for the purpose of causing the yarn to be delivered without slip between it and the roller. In a two-grooved roller, the roller is built up of two end discs A having lugs *a* spaced evenly around their inner faces, an intermediate disc B having lugs *b* spaced evenly around each face, and two spacer discs C having slots *c* spaced evenly around their peripheries at half the distances apart of



a and *b*. C are of less diameter than discs A and B and the axial width of *a* and *b* is greater than half the width of the slots *c* but less than the whole width. The discs A, B and C are secured on a hub D with the projections *a* alternating with the projections *b*, and *a* and *b* project into the slots *c*. As the latter are of less diameter than the discs A and B and the projections do not extend entirely across the width of the slots *c*, two grooves are formed in the roller around which the yarn *y* passes and the yarn is caused to take a tortuous path since only alternate projections *a* or *b* enter the slots *c* of the spacer discs. In addition to the frictional contact of the yarn *y* with the face of the spacer disc C, its frictional contact with *a* and *b* the yarn, changes direction, adds additional resistance to differential movement between the yarn and the roller.

813,681 Stop Motions for High-Speed Winders

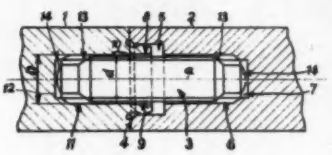
THOMAS HOLT LTD., *Atlas Iron Works, Whitworth Road, Rochdale, and* E. BRIERLEY.

Stop motion for winding machines which reduces to a minimum the risk of breakage of yarn due to entanglement. In the event of an entanglement occurring, the stop motion brake is applied to the package driving roller simultaneously with the application of means to positively arrest the turning movement of the swift. Also simultaneously, the tension on the length of yarn between the swift and the yarn package is adjusted to prevent undue tension being applied due to the stoppages. The operator then straightens out the entanglement and restarts winding, whereupon the tension compensating means returns to initial position, and the winding package and swift are free to turn simultaneously.

813,708 Improved Steel Roller Coupling

JOH. JACOB RIETER AND CIE., *Winterthur, Switzerland.*

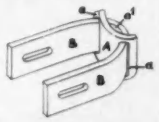
Improved fluted drawing rollers which are connected by couplings. Drawing rollers 1 and 2 are connected by a screw-threaded bolt 3 and have end faces 4 which are perpendicular to the common axis *a* of the rollers. Roller 2 has a gauged hardened centring bore 5, from which a thread bore 6 extends and terminates in an end face 7 parallel with end faces 4. Roller 1 has, for engagement in the centring bore, an extension 8, the surface of which is hardened and shaped to ensure an accurate fit. An unthreaded recess 9 is formed in extension 8 and extends into the plane containing the end faces 4 so that the most heavily loaded portions 10 of the bore 11, can be located in that part of the roller which, by reason of its greater wall thickness, cannot be affected by a slight deformation of the first supporting turns 10 of the thread, which are most heavily loaded. The threaded bolt 3 has at both ends a short portion terminated by a meniscus-shaped portion 14 and adjoining a cone 13. In the event of the bolt being screwed in too far and thus encountering the end face 7, 12 of the threaded bore, the portion 14 prevents the bolt from performing a guiding function and thus avoids any detrimental effect on the centring. A further step for ensuring that the bolt cannot perform any guiding function, resides in allowing the bolt to float in the bores 6, 11 by making the threaded diameter *d* of the bolt 3 smaller by about 2 to 3% than the normal external diameter D of the threaded bore.



813,874 Improved Loom Buffers

W. R. BROOKSBANK, *Embsay Tannery, Skipton.*

Describes removable buffers and picking pads for lug straps, connecting straps, or checking straps for propelling or checking the picking sticks of looms The buffer or picking pad A may be formed from a layer of resilient material such as leather, rubber or polyurethane and is provided with a pair



of slots *a*. through which the strap B is threaded. The buffer occupies a suitable position between the ends of the strap B to engage the picking stick C. The pad A when in position on the strap B may assume a U shape facing in the opposite direction to that of the strap thereby providing an air space *a*1 between the rear of the pad and the face of the strap, or it may be unbent.

814,125 Improved Balloon Control Rings

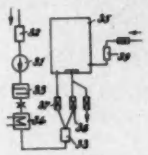
TWEEDALES AND SMALLEY (1920) LTD., *Globe Works, Castleton, Rochdale.*

A control ring in a spinning or twisting machine is so shaped that taking a radial cross-section of the ring, the control surface is a straight line, the control surface being inclined to the vertical so that the upper end of this surface is smaller in diameter than the lower end. Preferably two control rings are applied to the balloon, one above and one below the maximum apparent balloon diameter the upper control ring being shaped as described and the lower control ring having a control surface which, on a radial cross-section of the ring is a vertical straight line. Both rings are preferably the same or slightly larger in internal diameter than the internal diameter of the ring when applied to a ring spinning machine. The upper ring is preferably arranged to move in unison with the lappet rail, and the lower ring is preferably arranged to move in unison with the ring rail.

814,127 Novel Drying Method for Fabrics

GEBRUDER SUCKER, G.M.B.H., *Munchen Gladbach, Rheinland, Germany.*

A process for the treatment of materials by means of impulses imparted to a stream of fluid containing the materials. The



blower 31 sucks in the air through the filter 32 and forces it through the noise silencer 33 into the steam heated heat exchanger 34. It is then conducted through valve 36 to the material in the dryer 35 in drying from the interior to the exterior of the material, and through the valve 37 in drying from the exterior so the interior of the material. The material is carried on a spool having a hollow spindle so that the steam can pass radially through the material in either direction. According to the conditions of flow in the heat exchanger, the impulse element can also be placed at the crossed point in front of the heat exchanger 34. The impulse element 39 in the steam pipe serves also in the case of drying by steam under pressure and allowing the latter to flow in impulses.

814,848 Twisting and Spinning Machines

SKF KUGELLAGERFABRIKEN GESELLSCHAFT MIT BESCHRANKTER HAFTUNG, 13 *Ernst Sachs Strasse, Schweinfurt am Main, Germany.*

A yarn twisting or spinning machine in which the yarn is guided through a passage in a member rotating in a housing. The rotary member is provided with tracks constituting curve races for rolling bearings and has the guide passage running straight over its whole length inside the rotating member. The guide can be of substantial length so that sharp bending of the yarn is avoided.

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Personnel Manager,
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AN interesting opportunity is about to be created in a progressive West Riding textile company engaged in the manufacture of synthetic fabrics. The successful applicant will be an A.T.I. or have similar qualifications and be aged 21 - 23. He will be given training in all the technical and commercial activities of the company and will eventually be required to accept executive responsibilities as personal assistant to the General Manager. Please apply in confidence with outline of education and career to Box TU55, "Textile Manufacturer," 31 King Street West, Manchester 3.

PATENT EXAMINERS AND PATENT OFFICERS. Pensionable posts for men or women for work on the examination of Patent applications. Age at least 21 and under 29 (36 for Examiners), with extension for regular Forces Service and Overseas Civil Service. Qualifications: normally first or second class honours degree in physics, chemistry, engineering or mathematics, or equivalent attainment, or professional qualification, e.g. A.M.I.C.E., A.M.I.Mech.E., A.M.I.E.E., A.R.I.C., London salary (men) £655 - £1,460; provision for starting pay above minimum. Promotion prospects. Write Civil Service Commission, 17 North Audley Street, London, W.1, for application form, quoting **S/128/60**, and stating date of birth.

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YOUNG Swiss, 30 years, seeks employment for Autumn 1960 or Spring 1961 as a textile-designer in order to learn English. Has already some knowledge. Interview in England possible in August or September. Offers to Box A52 171Q, Publicitas, Basle, Switzerland.

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FORKLIFT TRUCKS FOR SALE. Diesel, petrol and electric. List available. Also forklift trucks wanted. State price and particulars. Speed Electrics, Dept. TM, Church Street, Basford, Nottingham.

FOR SALE. Bellows Cutting Plant, 60 ins. Comprising Reeler and Cutter. Can be seen running. Accept any reasonable offer. Box No. TT54, "Textile Manufacturer," 31 King Street West, Manchester 3.

WANTED in good condition, Sample Spinning or Twisting Frame, or combined Sample Spinning and Twisting Frame. Give full details including make, price, condition, etc., to Box No. TU58, "Textile Manufacturer," 31 King Street West, Manchester 3.

FOR SALE. Jacquard looms, 60-in. reedspace, W. B. White, six shuttle circular box, centre weft fork, individual drive from 1 h.p. motor. Complete with 600s coarse-pitch jacquards (Peter Walker, Blackburn), double-lift, double-cylinder; harness for 9,700 ends, tied-up to give 200 end/in. In excellent condition. Replies to Box TU56, "Textile Manufacturer," 31 King Street West, Manchester 3.

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FOR SALE. Cotton Impregnating Processing Plant comprising perculators, centrifuge, vacuum ovens, humidifiers, scutching, carding, cartonning machines. Box No. TU57, "Textile Manufacturer," 31 King Street West, Manchester 3.

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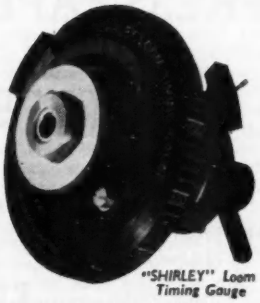

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